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Federal Options for Reducing Waste Disposal

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FEDERAL OPTIONS FOR REDUCING WASTE DISPOSAL

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PREFACE

The rising output of municipal waste has created a number of issues for states and localities: where to site new landfills and incinerators, how to slow the growth in the creation of waste, and how to encourage recycling, reuse, or composting--activities that reduce the need for more landfill or incinerator capacity. State and local governments have taken many actions; recycling programs have spread dramatically in recent years. But some efforts of individual states have been frustrated because the markets for recycled materials, and goods produced using them, extend beyond state boundaries. This study, prepared at the request of the Senate Committee on the Budget, examines several policy options that would be more practical and effective when applied at the federal rather than the state or local level. The options would reduce the amount, and perhaps the toxicity, of household waste through the use of economic incentives that would affect households, manufacturers, or collectors of waste and recyclable materials. In accordance with the mandate of the Congressional Budget Office (CBO) to provide objective and impartial analysis, the study contains no recommendations.

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SUMMARY

Americans generated 4.0 pounds of solid waste per person per day in 1988, and this figure is expected to grow to 4.2 pounds by 1995. Concern about the amount and growth of municipal solid waste, the difficulty of disposing of it, and the potential health and environmental hazards of some waste components have led to widespread interest in decreasing the amount of waste generated and increasing the amount diverted for recycling and composting.

One approach to the problem would be to use price incentives. Prices can be an effective mechanism for allocating resources, including waste disposal capacity. In order for prices to work effectively it is important that individuals bear the full costs of their actions. An ideal pricing system, in which households and businesses were charged according to the amount and toxicity of waste they disposed of, would provide them with an economic incentive to adopt a variety of disposal-reducing activities, including altering their purchasing patterns, reusing items within their homes, composting, and recycling. A close look at the pricing of municipal solid waste in the United States reveals that the existing price mechanism does not provide such incentives. Households typically pay for their waste disposal through flat fees that do not vary with the amount or toxicity of their waste.

Under ideal pricing, households and businesses would have an incentive to balance the cost of their disposal-reducing activities against the benefits that society receives from them. In theory, the prices charged would reflect the costs that society bears for waste disposal. The balancing of costs and benefits would bring about the "right" amount of disposal-reducing activities.

An ideal system of pricing would be virtually impossible to carry out. Many communities have experimented with programs based on some of the principles of ideal pricing. Under these programs, called unit-based pricing programs, households are charged for each bag or can of waste that they dispose of. Unit-based pricing shows a great deal of promise in some communities, but its use might not be appro-

priate in others. A number of problems would arise in adapting the program to the characteristics of the community (such as population density, income levels, and prevalence of multifamily dwellings). The Environmental Protection Agency is currently conducting research to resolve some of these issues. The amount of illegal disposal that would

SUMMARY TABLE. CHARACTERISTICS OF FIVE POLICIES DESIGNED TO REDUCE WASTE DISPOSAL

Policy	Range of Coverage	Displaces Recycled Materials in End Uses?	Discourages Consumption of Waste-Intensive Items?
Applied Unit-Based Pricing	All items in waste stream	No	Yes for bulky or heavy items. No for toxic items
Disposal Tax and Reuse Subsidy	Selected items	Only in minor end uses	Yes for covered items. Tax could be set to reflect toxicity and volume
Virgin Material Tax	Probably specific virgin materials in selected items	Those that do not serve as substitutes for covered virgin materials, including exports	Discourages consumption of items containing covered virgin materials
Investment Tax Credit	Recycled materials in end uses that qualify for tax credit	Significant displacement: exports, end users with existing capital equipment, end uses that do not require qualifying capital	No. Could encourage consumption of items that qualify for tax credit
Recycling Credit System	Selected items	Only in minor end uses	Discourages consumption of covered items

(Continued)

occur under unit-based pricing is of particular concern. In addition, the programs adopted so far have not varied their disposal charges according to the characteristics of the waste, and therefore have not provided households with an incentive to reduce its toxicity.

SUMMARY TABLE. Continued

Policy	Encourages Illegal Disposal?	Easy to Administer?	General Comments
Applied Unit-Based Pricing	Yes	May require new billing system for waste collection, or distribution system for bags. Enforcement is primary concern	Promising, but many questions arise about types of communities where it would be successful
Disposal Tax and Reuse Subsidy	No	Government must assess tax, distribute subsidy, distribute remaining funds. Verifying subsidy eligibility would be biggest task	Provides an incentive to balance costs and benefits. May be particularly useful for toxic or hard-to-dispose-of items
Virgin Material Tax	No	Administration very difficult for imports	Limited effectiveness unless it covers broad range of virgin materials. Widening coverage would complicate administration
Investment Tax Credit	No	Relatively easy to implement	May subsidize investments without decreasing disposal. Equity issue associated with uneven coverage
Recycling Credit System	No	Government must assess credit requirements and verify credit sales. Verifying legitimacy of credits sold would be biggest task	Unique in that it guarantees a recycling rate. Recycling rate must be carefully chosen. May be particularly useful for toxic or hard-to-dispose-of items

SOURCE: Congressional Budget Office.

While an ideal pricing system is not feasible in practice, it provides a benchmark for comparing alternative policies. This study considers four alternative policies: a combination disposal tax and reuse subsidy; a virgin material tax; an investment tax credit for recycling; and a recycling credit system. In addition to comparing the incentives for disposal-reducing activities under each policy with those that an ideal system of pricing would provide, the report examines the relative difficulty of administering each of the policies. Policies designed to create the appropriate incentives for waste-disposal reduction will make society better off only if the cost of administering them does not outweigh their benefits in the form of disposal costs avoided. See the Summary Table for a summary of the incentives each policy provides and the feasibility of administering it.

None of the policies considered provides an incentive for the full range of disposal-reducing activities that ideal pricing would motivate. None of the policies would encourage the reuse of materials (such as containers) within the home, and only one of them would potentially encourage composting. On the positive side, none of the four policies would provide an incentive for disposing of waste illegally. In addition, several of the policies would offer an opportunity to target particularly hazardous or hard-to-dispose-of items in the waste stream.

A DISPOSAL TAX AND REUSE SUBSIDY

Producers and importers could be taxed according to the cost of disposing of the goods that they produce. Final users of recycled materials could apply for a subsidy equal to the disposal costs avoided.

The disposal tax would discourage the consumption of products with high disposal costs. The reuse subsidy would provide domestic manufacturers and exporters with an incentive to increase their use of recycled materials, such as scrap paper, glass, and aluminum. Like ideal pricing, the disposal tax and reuse subsidy policy could encourage increased recycling and decreased production of waste-intensive goods up to the point at which the costs of these changes were equal to the benefits (in the form of avoided disposal costs).

Since disposal costs vary across the country, the level of the disposal tax and reuse subsidy should also vary, depending on the region in which the product was ultimately disposed of. This would make the policy difficult to administer. If the disposal tax and reuse subsidy were set equal to the average national disposal cost, incentives would be too high in regions with low disposal costs and too low in regions with high disposal costs.

Ideal pricing would cover *all* materials that a household disposes of--from food scraps to old appliances. Obviously it would not be feasible to set an individual disposal tax and reuse subsidy for every item in the waste stream. The taxes and subsidies could be limited to items that can be easily identified, that have disposal costs that do not vary with consumption patterns, that have a limited number of producers and importers, and that, when recovered from the waste stream, are used by a limited number of final users. Items that might be considered for this type of policy include selected paper products, beverage containers, tires, and batteries. Since this policy would not encourage illegal disposal, it might be particularly suited to items that are hard to dispose of.

The disposal tax could be assessed on the basis of weight or per unit, depending on the characteristics of the product. Ideally, taxes should reflect both a product's toxicity and the volume of space it takes up in disposal. Determining the appropriate disposal charge for individual products would be an important and difficult task.

Since final users of recycled materials may purchase them in condensed form (such as crushed aluminum or glass), reuse subsidies would be easiest to administer on the basis of weight. Verifying the amount of recycled material used by firms that applied for a subsidy would be a major challenge in administering this policy.

After the subsidies were paid, the remaining revenue from the disposal tax could be rebated to communities to help cover their disposal costs, perhaps according to their population.

A VIRGIN MATERIAL TAX

Producers and importers could be taxed according to the amount of virgin materials contained in their products. A virgin material tax would bring about an increase in the recycled content of some products and would result in an overall increase in the level of recycling. Unlike ideal pricing, however, the tax would not encourage *all* end uses of recycled materials. It would not encourage the increased use of recycled materials in cases in which they do not replace virgin materials. It could, in fact, crowd out these other end uses: as firms subject to the virgin material tax tried to increase their consumption of recycled materials, the price of recycled materials would rise, discouraging other final users (those not subject to the tax) from using recycled materials.

The number of domestic end uses that could be crowded out would depend on how broadly the taxable virgin materials were defined--the broader the definitions, the less likely that other domestic uses of recycled materials would be crowded out. Exports are one major end use of recycled materials that would be crowded out by a virgin material tax regardless of how broad the definition was.

A virgin material tax would only discourage the use of taxable virgin materials. An ideal system of unit-based pricing, however, would discourage the use of *all* inputs that add to the disposal cost of a product. A virgin material tax could cause producers to make input substitutions that reduce their tax payments but do not reduce the disposal costs of their products. The more broadly the taxable virgin materials were defined, the less likely it is that these unwanted substitutions would occur. The tax would discourage the consumption of goods containing taxable virgin materials. Ideal pricing, on the other hand, would discourage the consumption of all goods with high disposal costs.

Importers would be subject to the virgin material tax, and determining the amount of tax they should pay would be a major stumbling block. For example, an importer of a case of wine is unlikely to know the virgin content of either the wine bottles or the box that contains them. It would be extremely difficult for the government to verify this information. The more broadly taxable virgin materials were defined, the more difficulties would be encountered. The tax might need to be

limited to specific virgin materials contained in selected items. Items that would lend themselves best to a virgin material tax are those that have limited imports (or for which the virgin content of imports can be identified) and in which the use of virgin materials is linked to the presence or absence of capital equipment.

The most feasible base for a virgin material tax would be weight. A weight-based tax could, however, result in unwanted substitutions that would not reduce the amount of waste disposed of. For example, a weight-based tax would encourage substituting lightweight plastic for heavier-weight glass, even though plastics take up comparatively more space in landfills than glass and are more difficult to recycle. To avoid this problem, a weight-based tax should reflect the volume-to-weight ratios of specific materials. It could also be adjusted to reflect the toxicity of different materials.

AN INVESTMENT TAX CREDIT FOR RECYCLING

Firms could be given tax credits for investing in capital equipment used in recycling--for example, equipment used in collecting, separating, and processing recycled materials or in manufacturing recycled products.

A key issue with an investment tax credit is whether it would affect firms' decisions to purchase such capital equipment. To the extent that the investment tax credit merely subsidized investments that would have occurred anyway, it would not reduce the amount of municipal solid waste disposed of. A federal recycling tax credit was in effect from 1978 through 1982, but the extent to which it altered firms' investment decisions is unknown. Research on other federal and state tax credit programs has raised significant doubts about the effectiveness of tax credits in encouraging investment.

Unlike ideal pricing, an investment tax credit would not encourage all end uses of recycled materials. Firms that do not require specialized capital equipment to use recycled materials in their production processes would benefit comparatively little from a tax credit. Likewise, firms that already have the capital equipment necessary to use

recycled materials would not directly benefit--in fact, they might use less recycled material if the increased use of recycled material by firms that qualified for the tax credit raised the price of those materials. The investment tax credit might be perceived as unfair since it would lower recycling costs for firms that had not previously invested in recycling equipment.

Assuming that the tax credit was effective in encouraging some firms to install recycling capital equipment and expand their use of recycled materials, the recycled content of these products would increase and recycled material prices could rise. The extent to which the overall level of recycling would increase, however, would depend on the extent to which higher prices of recycled materials crowded out the use of those materials by firms not directly benefiting from the tax credit.

An investment tax credit would probably be the easiest of the four policies to administer. Firms eligible for the tax credit would make themselves known to the government. Eligibility would be relatively easy to verify since it would require making a large visible capital investment. Since eligibility would be limited to domestic firms, none of the problems associated with imports would arise. The biggest challenge in administering the policy would be to determine what investments were eligible for the tax credit, which could require some knowledge of the production processes using the equipment.

Although an investment tax credit would probably be the easiest to administer of the four policies examined in this study, it would probably also be one of the least effective in reducing waste disposal.

A RECYCLING CREDIT SYSTEM

Producers and importers could be held responsible for ensuring that a certain percentage of their product had been recycled. They would do this by buying enough recycling credits to certify that the required amount of recycled material had been used. Firms that used the product would generate recycling credits that they could sell.

Like ideal pricing, this policy would potentially encourage *all* end uses of covered recycled materials. In this respect it would be preferable to a virgin material tax or an investment tax credit. In order to make the policy feasible, however, it might be desirable to allow only major final users of recycled materials to generate recycling credits.

The policy is unique in that it would ensure that a given recycling target was met. The recycling credit system would help ensure that the recycling target was met at the lowest overall cost both to industry and to consumers of the covered goods. The costs and benefits of increasing recycling would have to be weighed when choosing the target rate of recycling.

To determine the number of recycling credits that producers and importers must buy, the government would need to determine the quantity of the product that each firm produced or imported. This would be feasible only when products were easy to identify and quantify. It would also be easier when there were a limited number of producers and importers of the covered product, as well as a limited number of final users of the recycled material. As with the disposal tax/reuse subsidy policy, potential objects for a recycling credit system include selected paper products, beverage containers, tires, and batteries. This policy would not encourage illegal disposal, and might be particularly well suited for removing toxic or hard-to-dispose-of items from the waste stream.

Requirements for recycling credits could be determined by weight or by unit, depending on the nature of the covered product. The credits would have to be generated by weight, however, since many final users of recycled materials buy them in a condensed form. Verifying the legitimacy of the credits generated (that is, verifying that the amount of credits sold was consistent with the amount of recycled materials used) would probably be one of the biggest tasks in administering this policy.

An active and competitive market for recycling credits would be necessary for this policy to be effective. Firms would buy and sell credits only if the cost of completing the transaction was sufficiently low. Brokers would be likely to emerge to help link potential buyers and sellers. Transaction costs would be minimized if few regulatory re-

quirements were placed on trades (for example, requiring prior approval). The market would be competitive if no individual buyer or seller could influence the price of recycling credits. The existence of a large number of final users of the recycled material eligible to generate credits would probably assure a competitive market. Long-term contracts might be used to reduce the uncertainty associated with the future price of credits.

CHAPTER I

THE PROBLEM OF MOUNTING MUNICIPAL SOLID WASTE AND SOME OPTIONS FOR DEALING WITH IT

Americans generated 4.0 pounds of waste per person per day in 1988, and this figure is expected to grow to 4.2 pounds by 1995.[1] The reasons for the trend are not completely clear, but rising incomes, smaller households, more two-income families, and greater urbanization may all play a role. Rising incomes make possible increased consumption, and therefore increased waste generation. Smaller households may tend to buy smaller containers of products, with more packaging (and more waste) per volume of product. Two-income families are likely to rely more on disposable products and convenient packaging (for example, prepared food items). Finally, urban areas have been found to generate more waste per capita for some items, such as paper.[2]

The generation of waste at an increasing rate by a growing population results in an even faster increase in the quantity of waste. According to the Environmental Protection Agency, nearly 180 million tons were generated in 1988, and the amount is projected to grow to over 199 million tons by 1995.[3] The growing quantity of waste needs somewhere to go. The vast majority--over three-quarters--went to landfills in 1990, according to a recent survey.[4] Of the rest, about one-half was incinerated, and the remainder was recycled.

The environmental effect of waste disposal is a topic of debate. Some people argue that leakage from landfills and emissions from in-

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1. Environmental Protection Agency, *The Solid Waste Dilemma: Agenda for Action*, EPA/530-SW-88-052 (September 1988); Office of Technology Assessment, *Facing America's Trash: What Next for Municipal Solid Waste?* (October 1989).

2. Office of Technology Assessment, *Facing America's Trash*, p.78.

3. Environmental Protection Agency, *Characterization of Municipal Solid Waste in the United States: 1990 Update*, EPA/530-SW-90-0041 (June 1990).

4. Estimates are reported in Jim Glenn and David Riggle, "The State of Garbage in America," *Biocycle* (April 1991).

cinerators threaten public health; others argue that current technologies make disposal facilities safe. The environmental and health effects may be debatable, but the problems that communities face in deciding what to do with their waste are not. The limited capacity of existing landfills in some areas and difficulties in siting new landfills and incinerators have put a premium on decreasing the amount of waste generated and increasing the amount that is recycled and composted.

Particular items in the waste stream may warrant special concern. For example, lead-acid (car) batteries account for two-thirds of the lead in municipal solid waste. Household batteries, fluorescent light bulbs, thermometers, and mirrors are sources of mercury, and plastics and rechargeable batteries are primary sources of cadmium.[5] Other household waste, such as cleaning products and yard and home maintenance products, may contain toxic substances. Items such as tires may pose particular problems since they are difficult to dispose of in landfills and are often stockpiled or illegally abandoned. Uncontrolled tire dumps can become breeding grounds for mosquitoes and a source of encephalitis, or result in fires that are difficult to extinguish.

This study examines actions that the federal government might take to address some of the problems associated with municipal solid waste. The Resource Conservation and Recovery Act (RCRA) is the major federal law dealing with municipal solid waste. The pending reauthorization of RCRA provides an opportunity to reassess the role of the federal government in this area. States and municipalities--the units of government traditionally responsible for municipal waste management--have already undertaken a variety of measures to discourage waste generation and encourage recycling.[6] This study considers policies that would be more practical and effective when applied at the federal level than by states.

The purpose of this study is not to provide a broad overview of municipal solid waste issues, but rather to examine some alternative

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5. Office of Technology Assessment, *Facing America's Trash*, p. 86.

6. A recent survey indicated that there were 2,711 curbside recycling programs in operation in the United States during 1990. See Glenn and Riggle, "The State of Garbage in America."

policies for reducing disposal requirements.[7] It addresses two questions in discussing each policy:

- Would this policy provide an effective set of signals for discouraging excessive waste generation and encouraging appropriate recycling?
- Would this policy be relatively easy or difficult to administer?

The discussion ends with a case study of how each policy might be applied to the disposal of old newspapers.

NATURE OF THE PROBLEM

Is the United States generating too much waste? The country currently recycles 13 percent of its waste--is this too little?[8] These questions can best be approached by examining the incentives that would be needed to bring about an "optimal" level of disposal.

Determining the "Optimal" Level of Waste Disposal

The activities that generate garbage also provide benefits for society.[9] For example, the packaging of food keeps it clean and may facilitate its preparation. Being able to dispose of garbage easily is also a valued benefit. Setting out trash for household pickup is quicker and easier than finding another use for it in the home, composting it in the backyard, or taking it to a recycling center. The incremental social benefits that society receives from waste disposal are represented schematical-

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7. For a comprehensive discussion of trends in municipal solid waste generation and an overview of issues associated with waste management and reduction possibilities, see Office of Technology Assessment, *Facing America's Trash*.

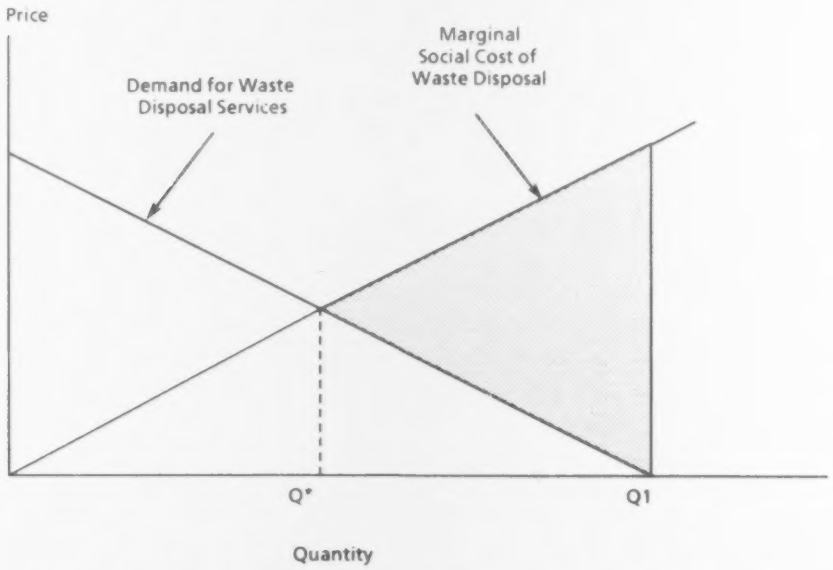
8. Environmental Protection Agency, *Characterization of Municipal Solid Waste in the United States: 1990 Update*.

9. This section is based on Tayler Bingham, Ram V. Chandran, and Terry Dinan, *The Old Newspapers Problem: Benefit-Cost Analysis of a Marketable Permit Policy*, report prepared for the Environmental Protection Agency (February 1990), pp. 2-1, 2-2.

ly in Figure 1, which indicates the quantities of waste disposal services that households and businesses would demand at different prices. As the price of these services decreases, the demand for them increases so that the demand line slopes downward.

The generation and disposal of solid waste, however, also impose costs on society, such as the costs of picking up the garbage and operating landfills and incinerators. There are also less obvious costs, such as the noise and odors associated with collection, the potential water and air pollution associated with landfills and incinerators, and the

Figure 1.
Social Costs of Improper Pricing of Waste Disposal



NOTE: The optimal level of waste disposal is at the point where the demand for waste disposal services equals the marginal social cost, indicated by Q*. If households are not charged for waste disposal, they will dispose of an amount of waste indicated by Q1, resulting in a net loss to society equal to the shaded area.

need for new facilities as current disposal capacity is used up. The marginal social costs associated with each unit of waste disposal are depicted by the ascending line in Figure 1, and increase with the amount of waste disposal.

From this perspective, society is not disposing of "too much" waste as long as the benefits associated with each unit of disposal are greater than or equal to the cost. The "optimal" level of disposal occurs when the benefits from the last unit of disposal are just equal to the cost. This optimal level of waste disposal is indicated by Q* in Figure 1.

In order for the optimal level of disposal to occur, the prices that are charged for solid waste services should reflect the additional (or "marginal") cost to society of providing those services. If households and businesses are not charged for waste disposal services, they will dispose of an amount of waste indicated by Q1, the amount of disposal services demanded at a price of zero. The consumption of waste disposal services in excess of Q* results in a net loss to society because the additional cost of providing those services (represented by the area below the marginal social cost line) is greater than the additional value society places on them (represented by the area below the demand line). The net loss to society for not charging for waste disposal is indicated by the shaded area in Figure 1.

Pricing Waste--The Economist's Ideal

An ideal pricing system would require both households and businesses to pay according to the amount and toxicity of their waste. Households account for approximately 70 percent of all municipal solid waste, and businesses for the remainder, according to estimates of the National Solid Waste Management Association. The optimal level of waste disposal (shown in Figure 1) would, in principle, be expected to result from the ideal pricing system provided that the prices charged reflected the cost that society bears for waste disposal, and that the pro-

gram could be perfectly enforced. This system would provide households and businesses with an incentive to balance the benefits that they receive from disposal services against the costs to society.[10]

Pricing Waste--The Current Method

Businesses typically rent dumpsters from private haulers and contract to have them emptied periodically. They can reduce their waste disposal costs by reducing the size of the dumpsters or the frequency with which the dumpsters are emptied. They have an economic incentive, therefore to reduce the amount of waste that they dispose of, but not to decrease its toxicity.[11] Since the disposal of hazardous items leads to higher environmental costs, an ideal pricing system would require that the cost of waste disposal vary not only with the volume of waste but also with its toxicity.

A fundamental failure in the pricing of waste disposal is that households are not charged according to the amount or toxicity of their waste. They typically pay for waste disposal services either through their local property taxes or by a fixed fee to a private collector. This means that the price they pay for each additional unit of waste disposed of is zero. (The amount of waste disposed of at a zero price is depicted by Q1 in Figure 1.) Under this flat-fee pricing system, households do not have a monetary incentive to reduce the amount of waste that they dispose of by changing their consumption behavior (to decrease the amount or toxicity of the waste) or by increasing their recycling and composting efforts.

The pricing of waste disposal is not ideal for either businesses or households. The failure of the pricing system is far greater for households, however, because they lack an economic incentive to reduce both

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10. Items that lead to additional waste may provide households and businesses with valued benefits. For example, increased packaging may prevent breakage, keep products free of contamination, or facilitate preparation. In addition, households and businesses benefit from the convenience of being able to easily dispose of their waste rather than having to sort it for recycling or find alternative uses for it.

11. An exception to this is for items that are actually classified as "hazardous waste," which require special treatment or disposal.

the amount and the toxicity of the waste that they dispose of whereas businesses primarily lack an incentive to reduce the toxicity of their waste. The focus of this report, therefore, is on the residential portion of municipal solid waste disposal.

ALTERNATIVE POLICIES

An ideal pricing system would charge each household for waste disposal services according to the amount and toxicity of its waste. Since important questions remain about the feasibility of such a nationwide system of pricing for residential waste removal, other policies are worth considering. An ideal pricing system would affect all of the waste generated by households, but the policies considered in this study would probably be applied only to individual components of the waste stream--those making up a significant share of residential waste, or that have the most potential for increased recycling, or that have hazardous characteristics requiring them to be diverted from the waste sent to landfills or incinerators.

An ideal pricing system would directly affect households, while the alternative policies examined in this report would directly affect the producers of items that households purchase. As described throughout this report, however, similar incentive effects on producers and households can be achieved regardless of the initial point of incidence.

The study examines four alternative policies that the federal government might adopt in order to reduce the amount and/or toxicity of waste disposal:

- A Disposal Tax and Reuse Subsidy. Producers and importers would be taxed according to the cost of disposing of the goods that they produce. Producers and exporters using recycled materials would receive a subsidy equal to the disposal costs avoided by the recycling of the materials that they use.

- A Virgin Material Tax. Producers and importers would pay a tax based on the virgin material content of the goods that they sell.

- An Investment Tax Credit for Recycling. Firms that purchase qualifying equipment would be eligible for a tax credit. Qualifying equipment might include capital used in collecting, separating, and processing recycled materials or in manufacturing products from recycled materials.

- A Recycling Credit System. Producers and importers would be responsible for ensuring that a certain percentage of the goods that they produce are recycled. They would meet this requirement by using recycled materials themselves or by buying "recycling credits" from producers who have reused the materials. Each recycling credit purchased would guarantee that some quantity of the material had been recycled.

WHY THESE POLICIES MAY BE MOST APPROPRIATE AT THE FEDERAL LEVEL

These policies would be more effective at the federal level than at the state or municipal level. All four policies would increase the demand for recycled materials, and some would also provide a motive for households to undertake changes that reduce the amount of waste generated in the first place. Recycled materials are often exchanged in markets that extend beyond state boundaries. An attempt by any one state to apply these policies would create only a minor increase in the demand for recycled materials. Furthermore, there is no assurance that the additional recycled materials demanded as a result of a particular state's actions would originate within that state. For example, if New Jersey were to provide a tax credit for newsprint producers who install deinking equipment, the additional old newspapers that would be purchased by the newsprint producers could come from other nearby states. New Jersey would bear the cost of administering the policy, but other states would receive the benefits.

National incentive-based policies designed to increase the demand for recycled materials might also alleviate the need for state laws that often have differing requirements. For example, seven states have passed legislation mandating that newspaper publishers use newsprint with varying levels of recycled content. Altering newsprint pro-

duction processes to comply with a multitude of different state requirements can be very costly. A uniform federal policy would reduce such inefficiencies.

STANDARDS FOR JUDGING ALTERNATIVE POLICIES

The incentives created by an ideal pricing system can be used as a benchmark in evaluating alternative policies. The more closely a policy replicates the incentives created by ideal pricing, the more likely it is to result in appropriate changes in the behavior of households, collectors, and manufacturers.

Programs with good incentives may be undesirable, however, if they are difficult and expensive to administer. The potential gain to society of reducing excess waste disposal is shown by the shaded area in Figure 1. Society would not be made better off by a policy if the cost of administering it was greater than the potential gain from reduced waste disposal. Unfortunately, there is currently not enough information to estimate the costs of administering each of the policies considered in this report, although the report examines the relative difficulty of administering each of them.

IMPORTANT ASSUMPTIONS

The underlying assumption in this report is that the goal of the policies considered is to reduce the amount and/or toxicity of waste disposal to the optimal level, not to conserve virgin resources per se. Although increased recycling may help in both cases, waste disposal and conservation of resources are separate problems and call for different overall solutions. For example, to achieve the optimal level of disposal, the prices charged for individual items under ideal pricing would reflect the cost of disposing of them. If the goal of the policy was to preserve virgin resources, however, the prices charged for virgin materials should reflect the scarcity value of the virgin resources rather than the cost of disposing of them.

Moreover, some of the changes that would occur under an ideal pricing system for waste disposal would not alleviate the problem of preserving resources. Ideal pricing would motivate increased exports of recycled materials and increased composting of waste, neither of which would increase the conservation of domestic virgin resources (see Chapter III). In this report, the prices of virgin materials are assumed to be set correctly and to reflect their scarcity value.

The report also assumes that proper environmental controls are in place on all production processes. Otherwise, determining how much recycling should take place would be more complex. For example, if proper environmental controls are in place, the optimal level of recycling of a material such as old newspapers may be determined by comparing the cost of recycling with the disposal cost that is avoided by recycling. If proper environmental controls are not in place, however, the net environmental effect of using old newspapers in alternative production processes must be considered as well. One must determine not only the relative amounts of old newspapers going to different production processes (such as newsprint, tissue paper, and corrugated boxes) but also the change in pollution created by using more old newspapers in each.

No solution can fit all problems. Preservation of virgin resources and control of pollution from production processes (including those that use recycled materials) are important needs, but one cannot expect that they will be met by a policy designed to solve the problem of waste disposal. Therefore, this study assumes that virgin resources are properly priced and that appropriate environmental controls exist on production processes. It then explores solutions for solving the problem of waste disposal.

Finally, the analysis assumes that the incentives provided by the policies under discussion would be strong enough to cause households, collectors, and producers to change their behavior. For example, it assumes that the disposal charge under ideal pricing would be high enough to make households reduce their purchases of waste-intensive goods and increase their recycling efforts. Likewise, it assumes that a virgin material tax would be high enough to make producers use less virgin material.

In reality, the magnitude of the change that each policy would bring about would depend on many factors in addition to the size of the incentive that each policy created, including the size of its tax, subsidy, disposal charge, or tax credit. The amount by which households decreased their consumption of waste-intensive goods when prices rose would depend on the availability of substitutes (for example, cloth diapers as opposed to disposable diapers) and how much people valued the convenience or satisfaction they received from the good whose price increased. The amount by which households increased their recycling in response to higher disposal charges or more convenient recycling programs would depend on their perception of the burden involved in recycling and the convenience they attached to mixed waste disposal. Likewise, the amount by which producers would increase their use of recycled materials in production as the price of recycled materials decreased (or the price of virgin materials rose) would depend on how easy it was to substitute recycled materials for virgin materials in the production process, whether changes in quality were perceived to result from the substitution, and the competitiveness of the industry.

CHAPTER II

THE ROLES OF HOUSEHOLDS, COLLECTORS AND PRODUCERS IN WASTE DISPOSAL

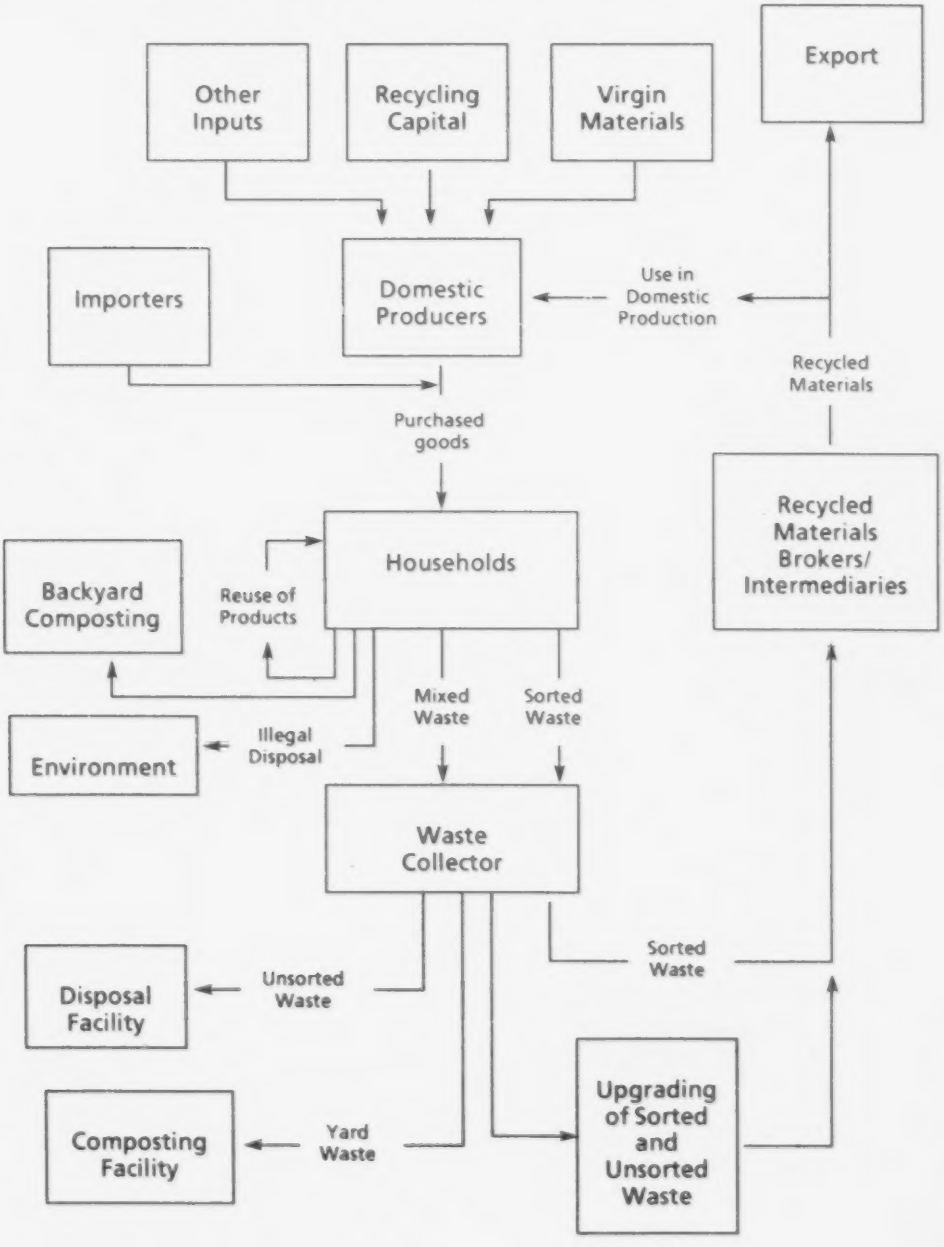
Households, collectors, and producers all play parts in determining the amount of waste disposal. Households can reduce the amount of waste disposal by generating less waste in the first place or by diverting waste through recycling and composting. Collectors of household waste can increase the level of waste diverted by offering convenient recycling and composting programs. Producers affect the amount of waste disposal through their decisions about product design and packaging, and their choice of recycled inputs. These various roles are shown in the flows of products, waste, and recycled materials in Figure 2.

HOUSEHOLDS' ROLE IN WASTE DISPOSAL

Households can reduce the amount and toxicity of unsorted waste that they set out for collection in several ways:

- By their purchase decisions--buying fewer disposable items (such as paper plates), switching to brands that offer reduced packaging (such as concentrated detergents), or reducing their purchases of items that are hazardous when disposed of (such as household cleaners, nail polish, or batteries);
- By reusing products within their homes--for example, reusing containers rather than disposing of them;
- By composting (either in their backyards or through neighborhood programs);
- By separating out recyclable items; and

Figure 2.
Flows of Products, Waste, and Recycled Materials



- By disposing of waste illegally--for example, by burning it in their backyards or dumping it in empty lots or at commercial dumpsters.

In this study, the first four activities are classed as "disposal-reducing" activities. All four reduce the amount of waste ultimately sent to the landfill or incinerator or illegally disposed of. The first two activities are "source reduction" activities--they reduce the amount of waste generated, not just the amount disposed of. Illegal disposal reduces the amount of waste collected from the household but not the amount ultimately disposed of.

The extent to which households will undertake each of these disposal-reducing activities depends on:

- The satisfaction they receive from undertaking source reduction, composting, or recycling;
- The convenience of the recycling and composting options that they are offered;
- The price of disposal per unit; and
- The relative prices and substitutability of products having different waste characteristics.[1]

When neither households nor producers are forced to bear the disposal costs of their consumption or production decisions (that is, when households pay flat fees and when producers are not levied charges based on the disposal cost of the items they produce), only the first two factors govern the amount of disposal reduction that households will voluntarily undertake. Households will balance the satisfaction they receive from disposal-reducing activities with the inconvenience and expense of undertaking them.

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1. The first three of these factors are pointed out in Glenn Morris and Duncan Hulthansen, "The Economics of Household Waste Generation and Disposal" (draft paper, Research Triangle Institute, Research Triangle Park, N.C., February 1990).

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COLLECTORS' ROLE IN WASTE DISPOSAL

Collectors provide a variety of waste disposal services--collection for disposal, for recycling, and for composting. Municipalities often provide these services directly. Alternatively, municipalities may contract with private collectors to undertake some or all of these services or may grant franchises to private collectors. When municipalities pay the collection and disposal costs themselves, they directly benefit from disposal-reducing activities (in the form of lower disposal costs and higher revenue from recycling). When municipalities contract with private collectors for these services, they may benefit indirectly through lower contract costs. Under franchise arrangements, municipalities typically do not benefit from avoiding disposal costs but can use them as a basis for arguing for lower rates for households.[2]

Collectors play a large role in determining the level of household recycling through their design of recycling programs. Collectors have a variety of means for increasing the convenience of recycling for households, including:

- Providing convenient recycling centers;
- Providing curbside collection;
- Increasing the frequency of collection;
- Providing households with special containers for recyclables; and
- Allowing households to mix recyclable materials and undertaking more sorting at the collector level.[3]

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2. Lisa A. Skumatz and Cabell Breckinridge, *Variable Rates in Solid Waste: Handbook for Solid Waste Officials*, prepared for the Environmental Protection Agency and the Seattle Solid Waste Utility (June 1990).

3. Ibid.

These measures increase household participation by shifting the cost of recycling from households to collectors. In addition, collectors can encourage households to divert waste for composting by offering frequent collection of yard waste.

PRODUCERS' ROLE IN WASTE DISPOSAL

Producers affect the amount of waste disposed of in two ways: first, through the disposal characteristics of the products that they produce, and second, through their decisions about the use of recycled materials.[4] For example, producers may be able to reduce the cost of disposing of their products by using less packaging or by making their products easier to recycle. In addition, they can divert waste from landfills and incinerators by using recycled materials in their manufacturing process. Because producers do not bear the disposal costs of the goods that they produce, however, they lack an incentive to consider disposal costs when designing their products. Similarly, because they do not receive the benefit of the disposal costs that are avoided when they use recycled materials, they lack a direct incentive to consider the disposal costs avoided when they use such materials in their production processes.

4. Producers also affect the amount of waste disposed of by their decisions about how to manage their own waste. For example, they can reduce the quantity of waste disposed of through office recycling programs. These types of actions are not examined in this report. As discussed in Chapter I, most businesses have at least some economic incentive to minimize the amount of waste that they dispose of since their disposal costs vary with the quantity of waste.

CHAPTER III

IDEAL PRICING AND UNIT-BASED PRICING

This chapter begins by examining the incentives for reducing waste disposal that would be created by ideal pricing (as opposed to flat-fee pricing). As shown in Chapter I, an ideal pricing system would be expected to result in the "optimal" level of waste disposal because the prices would reflect the full social cost of waste disposal. For this reason, it is useful to examine the incentives for households, collectors, and producers that ideal pricing would provide. The more closely the incentives of actual policies resemble those of ideal pricing, the more likely they are to move participants closer to the optimal level of waste disposal. The second part of the chapter examines the experiences of communities that have experimented with pricing systems based on the concept of ideal pricing (called unit-based pricing programs). While unit-based pricing offers a promising alternative to flat-fee pricing in some communities, many questions must be answered before it can be applied on a nationwide basis.

INCENTIVES UNDER IDEAL PRICING

The incentives of an ideal pricing system would work directly on households and indirectly on collectors and producers.

Households

Under an ideal pricing system, the price that households would pay for waste removal would vary with the quantity and toxicity of their waste. The collecting of items separated for recycling and composting would not necessarily be free. The price charged for each item should be equal to the difference between the cost that the collector incurs to collect and process the item and the revenue the collector receives from selling it. If the "net cost" is positive, households should pay a fee to

have the item collected. If the net cost is negative, then households should be paid to separate it out. This report assumes that the price households would be charged for recycling and composting their waste would be less than the price they would be charged for disposing of it directly, thus providing them with an incentive to separate items for recycling and composting.

Under an ideal pricing system, households would have an economic incentive to buy items that reduced the volume and toxicity of the

BOX 1
Mandatory Recycling

An ideal pricing system will result in the optimal level of recycling only if recycling programs are voluntary. When recycling is voluntary, each household balances its individual net cost of recycling against the benefit of lower disposal costs. Since only the households themselves know how much they are inconvenienced by recycling, only they are able to make the correct trade-off.

Under mandatory recycling programs, households must recycle even when the net cost of doing so exceeds the saving in disposal costs. Such households could include those composed of elderly people, who may be less able to do the sorting and bundling that recycling requires; households without adequate storage space for recyclables (such as those living in high-rise apartment buildings); and households with very limited time (such as single-parent households).

In spite of the advantages of voluntary recycling programs, mandatory programs are common. Of the 2,711 curbside recycling programs in the United States in 1990, 39 percent were mandatory.[1] Mandatory recycling programs offer several advantages to collectors. When households are forced to participate, collectors do not need to undertake as much effort to make recycling programs convenient for households. Mandatory recycling programs make the level of participation more certain. Under voluntary programs, the level of participation is harder to predict and may vary over time as the enthusiasm for recycling rises or falls. Certainty about participation rates is important to collectors, since capital investment is required. Finally, mandatory recycling programs may be perceived as being more fair than voluntary programs, since all households are required to "do their share."

1. Jim Glenn and David Riggle, "The State of Garbage in America," *Biocycle* (April 1991), p. 37.

waste they generated, to reuse items within their homes, and to put more effort into sorting items that could be recycled or composted. Because perfect enforcement is assumed under an ideal pricing system, no cheating would be possible--households would pay according to the amount and type of waste that they disposed of--and no illegal disposal would occur.

Households would undertake the optimal level of disposal-reducing activities because they would have an incentive to increase their participation up to the point at which the net cost to them of doing so (their inconvenience and expense minus the satisfaction and revenue that they received) was equal to the benefits that society received from having them undertake these activities (the avoided disposal cost).

Finally, an ideal pricing system would result in the optimal level of waste disposal only if recycling and composting programs were voluntary. If they were mandatory, households would be required to participate even when their net cost in doing so exceeded the benefits to society of reducing disposal (see Box 1).

Collectors

Under an ideal pricing system, the quantity and toxicity of mixed waste that collectors receive for disposal would decrease as a result of households' efforts to reduce their disposal of mixed waste. In addition, because households would have an economic incentive to put more time and effort into recycling and composting, collectors would be able to provide greater supplies of recycled materials at lower prices.

An ideal pricing system would require that the ultimate generators of waste--households and businesses--pay according to the amount and toxicity of waste they dispose of. Even lacking an ideal pricing system, society could move toward the optimal level of recycling if municipalities took full account of the costs of waste disposal and were led by this assessment to offer household recycling programs. Municipalities often fail to recognize the full costs of waste disposal (see Box 2).

Producers

An ideal pricing system would provide manufacturers with an indirect incentive to take disposal costs into account. Because households would have to pay according to the amount of waste they generated,

BOX 2
Do Municipalities Take Adequate Account of Disposal Costs?

While only a few households in the United States pay for waste disposal according to the amount of waste that they generate, many municipalities do so. The more waste they dispose of, the more their waste collection and disposal expenditures increase. Often they do not fully recognize and account for these costs.

The environmental costs associated with waste disposal are often hard to determine. Many municipalities fail to plan for the cost of building additional disposal capacity, and fail to reflect that expense in their current cost of waste disposal.[1] Even more straightforward costs are often obscured in municipal budgets. A survey by the Office of Technology Assessment found that "the various components of municipal solid waste costs generally are not well-defined or accounted for." This occurs because many municipalities pay for collection and disposal out of general revenues, bond funds, grants, or some combination of these, thereby obscuring the costs within the budget.[2]

If all municipalities took the full avoided cost of disposal into account, most would undertake more recycling. They would find it worthwhile to increase the number of recycling programs and to make these programs more convenient for households. (In some cases, however, they might find that existing recycling programs are not economic when they compare the full cost of disposal with the cost of recycling.)

While the amount of recycling would generally increase if municipalities took disposal costs into account, households would not have an incentive to reduce their consumption of waste-intensive goods, or to undertake other measures, such as reusing old containers, unless charges at the household level were on a per-unit basis.

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1. Frederick C. Dunbar and Mark Berkman, "Sanitary Landfills Are Too Cheap," *Waste Age* (1987).

2. Office of Technology Assessment, *Facing America's Trash: What Next for Municipal Solid Waste* (October 1989), p. 58.

they would seek to buy products with lower disposal costs. Producers could, therefore, increase their sales by making their products less costly to dispose of--by using less packaging, making liquid items in a concentrated form, or using fewer toxic materials. Because households would save money by recycling, the supply of recycled materials available would increase and their prices would fall. Lower prices for recycled materials would in turn provide producers with an incentive to use more of these materials.

Ideal pricing is a "supply-side" policy in that it would lead to an increase in the supply of recycled materials and a reduction in their prices. The four alternative policies discussed in this report are "demand-side" policies because they would increase the demand for recycled materials and lead to higher prices for them. As described in Box 3, the incentives for producers and households to recycle can be the same whether the policy initially effects the supply of, or demand for, recycled materials.

EXPERIENCE WITH UNIT-BASED PRICING

Although an ideal pricing system would provide households with an incentive to undertake the optimal level of waste reduction activities, little is known about its large-scale feasibility. As many as 100 communities have experimented with pricing systems based on the principles underlying ideal pricing (called unit-based pricing programs), but most of these communities are small. Seattle, with a population of approximately 500,000, is the largest city to have introduced unit-based pricing.[1]

Unit-based programs vary in several ways. The majority of programs require households to buy special bags for waste disposal. Seattle requires households to subscribe for several sizes of cans. High Bridge, N.J., requires households to buy stickers to affix to their own cans.[2] All of the existing unit-based pricing programs charge accord-

1. Glenn E. Morris and Denise Byrd, *The Effects of Weight- or Volume-Based Pricing on Solid Waste Management*, prepared for the Environmental Protection Agency (January 1990).

2. Ibid.

BOX 3
"Supply-Side" vs. "Demand-Side" Policies

"Supply-side" policies initially affect the suppliers of secondary (recycled) materials, such as households, and lead to lower prices for secondary materials. "Demand-side" policies initially affect the final users of secondary materials, such as manufacturers, and lead to higher prices for these materials.

Ideal pricing is a supply-side policy. It initially would affect households and provide them with an incentive to increase their recycling activities. The increase in household recycling would enable collectors to provide greater quantities of secondary materials at a lower cost and would lead to lower prices for those materials.

The four policies described in this report are demand-side policies. They initially would affect producers and provide them with an incentive to use more secondary materials. The increase in demand for secondary materials by producers would lead to higher prices for those materials.

Some researchers argue that demand-side policies are more effective than supply-side policies in encouraging final users of secondary materials to increase the quantity that they use. The same ultimate changes in recycling should result, however, regardless of the initial point of incidence. The lower prices that would result from a supply-side policy such as ideal pricing would decrease manufacturers' cost of using secondary materials. Similarly, demand-side policies, such as a subsidy to manufacturers using secondary materials, would encourage them to use more secondary materials. In this case, the subsidy would lower the cost of using secondary materials and should have the same effect on manufacturers as an equivalent reduction in prices for secondary materials.

Demand-side policies could be more effective in increasing the use of secondary materials than equivalent supply-side policies if they were more successful in attracting manufacturers' attention (for example, if manufacturers were more aware of a subsidy than of a drop in prices of secondary materials).

Other factors may affect the willingness of manufacturers to use secondary materials. They may perceive secondary materials as inferior, may own virgin resources, or may simply be resistant to change. The ability of incentive policies to overcome these barriers, however, should be the same whether the costs of using secondary materials are lowered through supply-side policies or through demand-side policies.

ing to the volume of waste generated, although some are reportedly exploring the possibility of weight-based pricing.

Measures of the effects of unit-based pricing are available for only three communities, and these estimates are based on fairly limited data. A 10 percent increase in the price of waste removal was estimated to result in a 2.2 percent decrease in conventional waste collection in Ilion, N.Y., and a 1.4 percent decrease in Seattle.[3] In Perkasie, Penn., a 10 percent increase in the price of waste removal, in combination with instituting free curbside recycling of paper, aluminum, and glass, was estimated to lead to a 2.6 percent decrease in conventional waste collection.[4]

There is, unfortunately, little information available on the costs of administering unit-based pricing programs. These costs might include those of providing specialized bags or containers and making changes in billing procedures, the costs of households' trips to stores or elsewhere to purchase bags, and the costs incurred by increased participation in recycling programs minus the savings from a decrease in conventional disposal.

All of the unit-based pricing programs currently in place fall short of the ideal pricing system in several ways. First, the price that households pay for waste disposal varies according to the volume of waste but not its toxicity. Second, the programs do not charge (or pay) households for the items they separate for recycling and composting. This means that households may be over- or underencouraged to recycle, depending on whether the net cost that collectors bear for collecting and processing recyclable items is positive or negative.

Third, these programs are not "cheat-proof." Surveys of Seattle's program found that between 14 percent and 22 percent of customers were putting out more cans for collection than they paid for. However,

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3. Morris and Byrd, *The Effects of Weight- or Volume-Based Pricing on Solid Waste Management*; and Lisa A. Skumatz, "A History of Seattle's Solid Waste Rates" (draft report, 1989).

4. Morris and Byrd, *The Effects of Weight- or Volume-Based Pricing on Solid Waste Management*.

nearly the same percentage were putting out fewer cans than they paid for.[5]

Finally, illegal disposal is a real concern because it enables households to reduce their expenditures on waste collection. Illegal disposal can take a variety of forms, such as burning waste, dumping it in vacant lots, and disposing of it at public facilities, private dumpsters, or in surrounding communities. Tracking illegal disposal is very difficult, and therefore most estimates of it are tenuous, but anecdotal evidence indicates that concern about it is warranted. Charitable organizations in Seattle reported significant increases in unwanted donations and garbage left at unattended drop stations after an increase in per-unit disposal charges.[6] After unit-based pricing was instituted in Perkasie, Penn., the borough reported a substantial increase in the burning of household trash in backyards, fireplaces, and wood stoves. There were also numerous reports of residents taking their waste to commercial dumpsters and outside the borough to a neighboring community.[7] Measures are being taken in these communities to reduce the problem of illegal disposal.

Ideally, households should pay higher disposal costs for toxic waste items, but in applied programs with imperfect enforcement this would create an even greater incentive to dispose of such waste illegally. The gains from providing households with better pricing signals must be carefully weighed against the potential environmental effects.

Unit-based pricing programs hold much promise, yet many questions remain to be answered before they can be considered on a nationwide basis. Further information on the costs of administering such programs would be useful, as well as better information about the potential for illegal disposal. Future research should attempt to identify the types of cities in which unit-based pricing programs may or may not succeed. Relevant factors may be the sociodemographic characteristics of the population, the density of housing, and the percentage of

5. Skumatz, "A History of Seattle's Solid Waste Rates," p 11.

6. Ibid.

7. Morris and Byrd, *The Effects of Weight- or Volume-Based Pricing on Solid Waste Management*.

families living in multifamily dwellings. The Environmental Protection Agency has initiated a study to investigate the effects of unit-based pricing programs.

CHAPTER IV

A COMBINATION DISPOSAL TAX AND REUSE SUBSIDY

Under a combination disposal tax and reuse subsidy policy, producers and importers would be taxed according to the cost of disposing of the goods that they produce. This would encourage them to reduce the amount or toxicity of the waste associated with their products. In addition, all producers and exporters would receive a subsidy when they used recycled materials, which would increase the rate of recycling.

The combination disposal tax and reuse subsidy would reduce waste disposal. As with an ideal pricing system, a desirable feature of the policy is that it could encourage changes in waste generation policy up to the point at which the costs of undertaking them (such as the increased inconvenience to households) would be commensurate with the benefits (disposal costs avoided). The disposal tax and the reuse subsidy should each be set at the cost of disposal in order to achieve this balancing of costs and benefits.

Achieving such a balance in each locality would be difficult. Administrative considerations would probably require that the tax and the subsidy be set at the national level. This would lead to too much reduction of waste disposal (including changes in purchasing behavior and recycling) in parts of the country with below-average disposal costs and too little reduction in areas with above-average disposal costs. The policy could be applied only to selected items in the waste stream. It might be particularly desirable for encouraging the recycling of toxic items because, unlike applied unit- based pricing programs, it would not encourage their illegal disposal. Its feasibility for any item would depend on the structure of the industry as well as on the characteristics of the product. Some likely items are shown in Table 1. These were selected because:

- They are items with a potential for increased recycling, or for which less waste-intensive substitutes are available;
- Their disposal costs are not affected by how they are used in the household; and

TABLE 1. PRODUCTS TO WHICH A DISPOSAL TAX AND REUSE SUBSIDY POLICY MIGHT BE APPLIED

Product	Percentage of Total Discards in 1988[a] By Weight	By Volume
Paper Products		
Newspapers	5.7	5.5
Magazines and Books	2.9	2.9
Disposable Diapers	1.7	3.3
Corrugated Boxes	8.1	8.4
Beverage Containers		
Beer and Soft-Drink Bottles	2.8	0.8
Beer and Soft-Drink Cans (Steel)	0.1	0.1
Beer and Soft-Drink Cans (Aluminum)	0.4	1.2
Wine and Liquor Bottles	1.2	0.3
Soft-Drink Bottles (Plastic)	0.2	0.4
Miscellaneous Items		
Tires	1.3	b
Batteries, Lead Acid	0.1	b
Used Oil	b	b

SOURCE: Congressional Budget Office, from Environmental Protection Agency, *Characterization of Municipal Solid Waste in the United States: 1990 Update* (June 1990).

a. Discards remaining after recovery of materials.

b. Not available.

- They can be easily identified, whether imported or produced domestically.

In addition, the smaller the number of producers and importers of these items and the smaller the number of producers and exporters that use them when they are recovered from the waste stream, the easier it would be to administer this policy.

Several states have adopted advance disposal taxes for specific waste items. Florida has a 10-cent per ton disposal tax for newsprint.[1] Maine has an advance disposal tax of $5 on the purchase of new major appliances, furniture, bathtubs, and mattresses and a $1 tax on the purchase of motor vehicle batteries.[2] Connecticut and Washington also charge a $5 disposal tax on purchases of motor vehicle batteries.[3] Connecticut's and Washington's programs are similar to the disposal tax/reuse subsidy described in this chapter because the $5 tax is rebated if an old battery is returned when a new battery is purchased. Under a new state law, Idaho has established a program for tires that is similar to the one described in this chapter. The state imposes a $1 surcharge on all tires sold in Idaho, and the revenue is used to subsidize recycling efforts. Firms that retread tires receive a subsidy of up to $1 per reprocessed tire, and other final users of old tires receive $25 per ton.[4]

State bottle bills also use the disposal tax/reuse subsidy concept. A deposit (generally two cents to five cents per container) is charged when beverages are purchased, and refunded when the containers are returned. Ten states currently have bottle bills. Bottle bills differ from the disposal tax/reuse subsidy policy described here in that the size of the deposit does not necessarily reflect the cost of disposal. In fact, most bottle bills were passed to reduce litter rather than the volume of waste disposal.

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1. Tellus Institute, *Disposal Fee Cost Study*, prepared for the California Integrated Waste Management Board (December 1990), p. 2-4.

2. Ibid., p. 2-2.

3. Ibid., p. 2-1.

4. "State/Province Watch," *Resource Recycling*, vol. 10, no. 6 (June 1991), p. 10.

INCENTIVES FOR PRODUCERS

The incentives that producers of covered items would receive under the disposal tax/reuse subsidy policy would be similar to those under ideal pricing, provided that the tax and subsidy were each set equal to the cost of disposal. Disposal taxes would increase production costs in direct proportion to the cost that disposing of the good imposes on society. Producers would be forced to "internalize" the costs. To minimize their tax payments, producers would want to decrease their production of waste-intensive goods and minimize the disposal costs of those goods that they produce--for example, by reducing the quantity or toxicity of waste resulting from their products. Producers would undertake these waste-minimizing activities as long as the cost of doing so was less than the tax they paid. The amount of waste reduction would depend on the level of the tax.

The reuse subsidy would provide a direct incentive for producers to increase their use of covered recycled materials (such as old tires or beverage containers). The subsidy would allow them to capture the benefits of the disposal costs avoided when they use recycled materials. It would decrease the relative cost of producing goods from these recycled materials, and therefore producers' use of them would increase. If the subsidy was offered for all possible uses of the recycled materials, the export of recycled materials would also be encouraged (because exporters would be eligible for the subsidy).

INCENTIVES FOR COLLECTORS

The supply of covered recycled materials would be expected to increase under both ideal pricing and the tax/subsidy policy, but for different reasons. Households would have an increased incentive to participate in recycling programs under ideal pricing, and therefore collectors would be able to supply greater quantities of recycled materials at lower costs. Under the tax/subsidy policy, the increased supply of covered recycled materials would be motivated by the higher prices created by the subsidy.

Prices for covered recycled materials would be bid up under the tax/subsidy policy because it would encourage domestic producers and exporters to use more of them. Higher prices, in turn, would increase the revenue that collectors of these materials receive. Collectors would then have an incentive to increase their expenditures on recycling, to provide more convenient recycling options to households, or to pay households for their recyclables. This would lower the cost that households bear for recycling and cause participation to increase. (See Chapter II for a discussion of ways in which collectors can reduce household recycling costs.)

INCENTIVES FOR HOUSEHOLDS

The tax/subsidy policy would provide an incentive for some, but not all, of the changes in household behavior that would be motivated by ideal pricing. If disposal costs were sufficiently high, both policies would provide households with an incentive to decrease their purchases of waste-intensive items. The disposal tax would raise producer costs, and therefore prices to consumers of covered items, in direct proportion to the cost of disposing of them. Like ideal pricing, therefore, these price changes would provide households with an incentive to buy items with lower disposal costs.

Some researchers argue that disposal taxes (paid at the point of purchase) would be too low to alter households' purchasing patterns, and advocate unit-based pricing instead.[5] For example, if the cost of disposal was $100 per ton, a metal can weighing a tenth of a pound would incur a disposal tax of only half a cent. Such a small increase in the purchasing price of the product would do little, critics say, to motivate consumers to choose alternative products with lower disposal costs. It should be noted, however, that the cost of disposing of an item would be identical under either the disposal tax policy or unit-based pricing. If the household had to pay $1 for each 20-pound bag of waste that it disposed of (equivalent to $100 per ton), it would pay half a cent

5. *Project 88 -- Round II. Incentives for Action: Designing Market-Based Environmental Strategies.* A public policy study sponsored by Senators Timothy E. Wirth and John Heinz (May 1991), p. 54.

for each tenth of a pound, and the extra cost of the can would be the same under both policies.

The real issue is whether the disposal costs would be perceived by households in the same way regardless of where they are paid--at the point of purchase (under a disposal tax policy) or at the point of disposal (under unit-based pricing). Arguments can be made both ways on this issue. On the one hand, up-front taxes may make the trade-off in disposal costs among alternative products more apparent to consumers. For example, if disposal taxes were assessed on the basis of weight, a six-pack of soft drinks would cost more in bottles than in cans. On the other hand, unit-based pricing could provide households with a better understanding of the cumulative effect of their purchasing decisions. Their total expenditures on disposal costs would be more apparent, and might increase their motivation to lower this expense.

Like ideal pricing, the tax/subsidy policy would cause an increase in household recycling. The higher prices for recycled materials under the tax/subsidy policy would provide collectors with an incentive to increase the convenience of recycling activities for households, or to pay households for their recyclables. These changes, in turn, would lead to increased participation in recycling programs.

That households would benefit from the subsidy, in the form of either lower recycling costs or payments for recyclables, is a crucial assumption if one is to expect similar effects from the tax/subsidy policy and ideal pricing. If collectors sought to increase household participation by making recycling mandatory, the similarity with ideal pricing would be reduced. In that case, collectors would be forcing households to recycle regardless of their individual costs rather than providing them with an incentive to recycle, and the costs of recycling by some households would exceed the benefits. (See Box 1 for a discussion of mandatory recycling programs.)

ADMINISTERING A COMBINATION DISPOSAL TAX AND REUSE SUBSIDY POLICY

An ideal disposal tax and reuse subsidy policy would cover all items in the waste stream, would vary among regions according to local disposal costs, and would be perfectly enforced. In reality, however, the policy would have to be limited to selected items in the waste stream, the tax and subsidy would probably need to be uniform throughout the United States, and enforcement would be imperfect. Important factors in enforcing the policy would be the number of firms subject to the tax or eligible for the subsidy, and the information available to verify compliance.

Products Covered by the Disposal Tax and Reuse Subsidy

Ideally this policy would cover all products that ultimately find their way into the waste stream, ranging from refrigerators to food scraps. Taxing each of these items according to their disposal costs and subsidizing all final users of them would obviously be impossible. Since it would not encourage illegal disposal of materials, a tax/subsidy policy might be more effective than unit-based pricing in encouraging the recovery of potentially hazardous or hard-to-dispose-of items (such as car batteries or tires). Narrowing the range of items covered by the policy would create an equity issue, because some producers and importers would be forced to internalize the cost of disposing of their products while others would not.

The feasibility of applying a tax/subsidy policy to selected items in the waste stream depends on the structure of the industry as well as the characteristics of the product itself. The case study in the Appendix discusses the feasibility of using this policy to encourage the recovery of old newspapers. Other items to which the tax/subsidy policy might be applied are listed in Table 1. The policy is more likely to be effective and easier to administer when it is applied to products having:

- Disposal costs that do not vary with consumption habits;

- Distinct identities, not subsumed in other products;
- A limited number of producers and importers; and
- A limited number of final users of the recycled material.

All of the products described in Table 1 have disposal costs that are not altered by the way the goods are consumed. An example of an item that does not meet this criterion is fresh food scraps. The amount of waste generated by fresh food purchases will vary among households depending on their tastes and habits.

Newsprint is an example of a product that is not subsumed into other products and can be easily identified. Newsprint is sold in rolls, and imports are generally classified as "newsprint." In contrast, "glass" is an example of a product that is often a component of other goods and not easily identified. To charge a disposal tax on all glass imports, customs officials would have to identify the glass components of a wide variety of products ranging from beer in glass bottles to glass windshields on imported cars. Limiting the category to "glass beverage containers" would simplify matters, since the range of covered products would be reduced significantly (to containers for alcoholic beverages and soft drinks) and the glass component of the product could be easily identified.

Disposal taxes are relatively easy to administer when the number of domestic producers and importers of the product is relatively small. The more narrowly the covered product is defined, the smaller the number of covered firms.

The reuse subsidy would be relatively easy to administer if only a small number of firms were eligible for the subsidy. Requiring that firms be major final users of the product would be one way to limit their number.

Setting the Levels of the Disposal Tax and Reuse Subsidy

The disposal tax and reuse subsidy should each reflect the cost of disposing of the covered product. The cost of disposal includes the cost of collecting the material and the cost of incinerating it or disposing of it in a landfill. The reuse subsidy should equal the cost of disposal if the costs of collecting the recycled material are reflected in the market price. This may not always be the case. The market price may be less than the cost of collection when municipalities are the main collectors of the material. Municipalities could offer recycled materials for sale at less than the cost of collection because of the savings they realize by not having to incinerate or dispose of the material in a landfill. If market prices already reflect these savings of avoided disposal cost, then the reuse subsidy should be less than the full cost of disposal.

If the tax and subsidy were set too high, producers would be encouraged to do more than they should to decrease the waste-generating characteristics of their products and to increase their use of recycled materials. The costs they would bear in bringing about these changes would be greater than the benefits that society would receive (in the form of avoided disposal costs). If the tax and subsidy were set too low, producers would not do enough; the costs they would bear would be less than the benefits society would receive from their efforts. Of course, the disposal tax and reuse subsidy would need to be updated periodically to reflect changes in disposal costs.

An ideal tax/subsidy policy would vary the tax and subsidy according to local disposal costs. If a uniform tax and subsidy were set at the federal level, they would probably reflect the *average* national disposal cost and thus would encourage too much effort in areas with below-average disposal costs, and too little in areas with above-average disposal costs. An advantage of unit-based pricing as opposed to the tax/subsidy policy is that household disposal charges would be set at the local level and would, therefore, reflect local disposal costs.

Costs of Collecting and Disposing of Mixed Waste. No national data on the cost of collecting mixed waste are available. A study on bottle

bills, however, estimated the cost of collecting mixed waste at $38 a ton.[6] A national survey of "tipping fees" charged at landfills and incinerators indicates that they range from $3 a ton in South Dakota to $150 in New Jersey.[7] If state tipping fees are weighted by population data, the national average tipping fee is around $27.45 a ton.[8] A rough estimate of the national disposal cost for mixed waste (including both tipping fees and collection costs) would be $65.45 a ton. Because tipping fees usually do not reflect the full range of costs associated with waste disposal, this estimate represents a lower limit. A more accurate estimate of a national average disposal cost would require information on the remaining disposal capacity and the environmental costs of disposal in different localities. The disposal costs of individual items or materials would have to be adjusted to reflect their toxicity and other difficulties in disposing of them, as well as the volume-to-weight ratio of each material or item taxed. If charges did not reflect the volume-to-weight ratios of materials, and their toxicity, the tax and subsidy might result in unwanted substitutions that reduced producers' tax payments but did not lower disposal costs.

The Tax Unit. The ideal unit for the tax would be likely to vary from one product to another. A specific tax on each item would work best for beverage containers. For a homogeneous item sold and imported by itself (not as an integral component of another good), such as newsprint, a weight-based tax might be preferable.

Volume-based taxes would best reflect the cost of disposal because they would vary with the amount of space that an item takes up in a landfill. Volume-based taxes would be difficult to administer, however. For example, it would be easier to determine the weight of a plastic container than to measure the volume of space that it represents. A

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6. Frank Ackerman and Todd Schatzki, *Bottle Bills and Municipal Recycling: A Preliminary Cost Analysis*, report prepared for the Environmental Protection Agency (November 1989).

7. Jim Glenn and David Riggle, "The State of Garbage in America," *Biocycle* (April 1991).

8. This tipping fee is for landfills only. Each state's reported tipping fee was weighted by state population data. Five states did not report tipping fees and were omitted from the calculation. In cases where states reported a range of tipping fees, the midpoint of the range was used. Ten states reported only a maximum tipping fee. In these cases, the reported maximum was used. This should not be viewed as an accurate reflection of a true national average cost of waste disposal, but as a crude estimate based on the best information currently available.

weight-based tax would be easier to administer but could still pose difficulties in the case of goods sold as components of other goods, such as wine bottles. For these goods, a specific tax would be easiest to administer. For example, a disposal tax could be assessed on each bottle of wine that is imported or produced domestically.

Ideally, specific charges would reflect the relative toxicity of the products as well as their volume. Because specific charges could be varied to reflect the toxicity of different goods (or the relative difficulty of disposing of them), the tax/subsidy policy would be particularly well suited for goods that are hard to dispose of, such as car batteries or tires. Existing unit-based pricing programs charge the same fee for all items in the waste stream, regardless of individual variations in disposal costs.

The subsidy should reflect the disposal costs that are avoided when the product is recovered. Since final users may buy scrap materials in condensed form, such as crushed glass or aluminum, specific subsidies per item would not be appropriate for these materials. Subsidies would be easiest to administer on the basis of weight. The amount of the subsidy provided per ton for different materials should, however, be adjusted to reflect their volume-to-weight ratio as well as their toxicity.

Parties Affected by the Policy

The disposal tax would directly affect all domestic producers and importers of the covered products. Consumers of these products would be indirectly affected by the resulting price increases.

The reuse subsidy would directly affect all eligible final users of the recovered material. Eligibility should be limited to those who can reuse the products in an environmentally sound manner. Eligibility for the reuse subsidy could be restricted to major final users in order to limit the number of firms eligible for the subsidy and reduce the administrative burden.

Information Requirements

To determine the amount of the disposal tax to collect, the government would need to know only the quantity of the good produced or imported. It would not have to determine the composition of the product, as it would with a virgin material tax. This would considerably reduce the administrative burden.

Final users of the secondary materials covered by the policy would file for a subsidy per ton. The government would need to verify the quantity of materials they use. This would be relatively easy in cases where the use of a certain quantity of the material was linked to capital equipment. For example, the capacity of deinking equipment at a newsprint mill would indicate the maximum quantity of old newspapers that could have been used by that mill in a given time period. Alternatively, final users could be required to keep receipts for their purchases of the covered material, subject to random audit.

Paying Disposal Costs

Under the tax/subsidy policy, as under ideal pricing or applied unit-based pricing, some of the covered items would be sent to the landfill or incinerator because not all households would respond to the incentives to change their consumption habits or to recycle. The amount of revenue collected by the disposal tax should be sufficient to pay for the disposal cost of the covered items that are not recycled.

To prevent households from paying twice for the disposal of the covered items (once at purchase and once when they pay their fixed fee for waste disposal services), the remaining revenue collected from the taxes (after the reuse subsidies are paid) could be allocated to communities. The government would need to develop rules for allocating these funds. Theoretically, the funds should be allocated to communities according to the quantity of covered items that they dispose of, and their disposal costs. This would obviously require a great deal of information and could have the perverse effect of providing an economic incentive for communities to dispose of more waste. A more pragmatic approach might be to allocate the remaining funds among communities according to their population. Distributing the excess revenue could increase the cost of administering the policy.

CHAPTER V

A VIRGIN MATERIAL TAX

A virgin material tax would tax the virgin content of products consumed in the United States, including products that are imported. The objective of the virgin material tax considered in this study would be to reduce waste disposal rather than to conserve natural resources per se (see the discussion in Chapter I). The tax could bring about an increase in the recycled content of some products and an overall decrease in the amount of waste disposal. The tax would be more likely to result in reductions in waste disposal when the virgin materials subject to the tax were broadly defined. Broadly defining them would discourage producers from making input substitutions that reduced their tax payments but did not reduce the amount of waste disposal. Regardless of how broadly virgin materials were defined, however, the tax would not encourage the export of recycled materials and could, in fact, "crowd out" this important end use.

Although broadly defining the virgin materials that would be subject to the tax would increase the effectiveness of the tax in reducing waste disposal, it would increase the difficulty of administering the tax. The tax would be especially difficult to assess on imports of finished products. To be practicable, a virgin material tax might have to be limited to specific virgin materials contained in selected products. Even if the tax was restricted to selected products, assessing it on imports would be more difficult than assessing the disposal tax described in the previous chapter. The feasibility of administering a virgin material tax on specific products would have to be determined on a case-by-case basis. The application of a virgin material tax to newsprint is examined in the Appendix.

INCENTIVES FOR PRODUCERS

A virgin material tax would encourage producers to use less of the taxed virgin material in their products. Use of recycled materials would rise as producers substituted them for the now more costly virgin materials. Greater demand for recycled materials would tend to raise their prices, thus encouraging more recycling, with the benefit of reducing waste disposal.

The effect of this policy on the demand for recycled materials would be less direct than the effects of other policies considered in this study, and it might encourage changes in production processes that would not increase the use of recycled materials. Producers might, for example, buy capital equipment that would let them more efficiently use the now more costly virgin material in producing their products. Such changes would reduce the use of virgin materials, but would not necessarily increase the use of recycled materials.

A virgin material tax would encourage end uses of recycled materials only when they could serve as substitutes for taxable virgin materials--for example, the use of scrap paper as a replacement for wood pulp in the production of paper and paper products. The tax would not encourage the use of recycled materials in cases in which they do not replace taxable virgin materials. For example, a virgin material tax would not encourage the use of scrap glass in the production of "glassphalt"--a substitute for asphalt--if the tar and gravel used in the production of asphalt were not classified as taxable virgin materials. The more broadly virgin materials were defined, the wider the range of end uses of recycled materials that would be encouraged. Ideal pricing, in contrast, would encourage the use of recycled materials in all possible end uses.

By raising the price of recycled materials, a virgin material tax would discourage the use of recycled materials in cases in which they did not replace taxable virgin materials, including exports. How successful a virgin material tax would be in decreasing waste disposal (by increasing recycling) would depend on how sensitive the other uses of recycled materials were to changes in prices and how responsive the supply of recycled materials was to changes in prices. Exports are one

large and growing end use of recycled materials that would not be directly affected by a virgin material tax.[1] If exports are relatively sensitive to market prices, then the increased use of recycled materials in cases where they replace taxable virgin materials could be partly offset by decreased exports. To the extent that this happened, the overall level of recycling would not increase and the amount of waste disposal would not decrease. This crowding out of exports, caused by higher prices of recycled materials, might be somewhat offset by the incentive given foreign producers to increase their use of recycled materials in products for export to the United States. They would not have to use recycled materials from the United States, however, to avoid paying the tax.

INCENTIVES FOR COLLECTORS

As under ideal pricing, the quantity of recycled materials provided by recycling programs would be expected to increase under a virgin material tax. The tax would increase the demand for recycled materials in cases in which they could substitute for taxable virgin materials. The increased demand would raise the prices of recycled materials and increase the revenue that collectors received from recycling. Collectors would have an incentive to increase their expenditures on recycling and to provide more convenient recycling options to households.

INCENTIVES FOR HOUSEHOLDS

While ideal pricing would provide households with an incentive to decrease their consumption of goods with high disposal costs, a virgin material tax would only provide them with an incentive to decrease their consumption of goods containing taxable virgin materials. It would increase producers' costs in direct proportion to the amount of taxable virgin materials in their products, but not in direct proportion to the cost of disposing of their products. The resulting price increases would provide a signal to households to decrease their consumption of

1. In 1990 the single largest export (by weight) out of New York Harbor was scrap paper, according to officials of the American Paper Institute (June 1991).

goods made from taxable virgin materials, but not necessarily of goods having high disposal costs. The more broadly virgin materials were defined, for purposes of the tax, the less potential there would be for households to respond to price signals that reduced their use of taxable virgin materials but that did not reduce the amount of waste disposal.

A virgin material tax would result in an increase in household recycling because it would increase the incentive of collectors to provide households with convenient opportunities for recycling. (See Chapter II for a discussion of means by which collectors can reduce recycling costs for households.) Increased convenience would lead, in turn, to greater household participation. But if municipalities mandated recycling in response to higher prices of recycled materials, households would be forced to recycle regardless of their individual costs of doing so. (See Box 1 for a discussion of mandatory recycling.) In this case the cost of recycling for some households would exceed the benefits.

Unlike ideal pricing, a virgin material tax would not encourage households to reduce their waste disposal in every possible way. A virgin material tax would provide households fewer incentives to reuse products within their homes or to compost waste.

ADMINISTERING A VIRGIN MATERIAL TAX

A virgin material tax would be more likely to result in reductions in waste disposal when the virgin materials subject to the tax were broadly defined. Administering a broadly defined virgin material tax would be very difficult, however.

Materials Covered by the Policy

Theoretically, a virgin material tax might cover a wide range of virgin materials, such as all types of paper and paper products, glass, aluminum, and plastic. In the extreme, all materials that are not recovered from the waste stream could be classified as taxable virgin materials. Widening the range of the materials covered would reduce the possibility of causing unwanted substitutions that would not encourage

reductions in waste disposal. However, a broadly defined virgin material tax would be nearly impossible to administer. Imported products would present a major stumbling block (see the discussion of information requirements below).

Assessing the virgin material tax on imported items would be more feasible if the tax was restricted to specific products. In general, it would be easier to administer on a specific product:

- If there were a small number of domestic producers;
- If the use of virgin taxable materials was linked to the presence or absence of capital equipment that could be readily identified. For example, newsprint producers who lacked capital equipment designed to remove ink from scrap paper could be assumed to use virgin materials; and
- If imports accounted for a relatively small share of the total amount of the item consumed in the United States, or if unique features of the item allowed the virgin content of the imports to be determined.

The case study in the Appendix describes the administrative issues associated with a virgin material tax on newsprint.

Setting the Level of the Tax

A fundamental issue with a virgin material tax (as with all other fees) is whether the level of the tax would be set high enough to achieve the desired environmental goal. If it was designed to reflect the collection and disposal costs of the good containing the virgin material, a lower-limit estimate for the tax would be $65 per ton (see discussion on page 38). (This estimate assumes that there are no losses of the virgin material during production, and that the total amount of the virgin material used in production is therefore equal to the total amount of the virgin material in the finished product.) If the tax was designed to achieve a certain level of recycling, it would have to reflect the cost to

industry of switching from virgin to secondary materials. This cost would vary among individual industries and types of materials.

Environmental taxes, in both the United States and Europe, historically have not been set at levels intended to achieve environmental quality goals, but have been designed to raise revenue.[2] These taxes are typically low, and have often been unrelated to the actual polluting behavior of individual firms.

An additional problem would be to determine the correct base for the tax. If the purpose of the tax was to preserve landfill space, then a tax based on volume would be more appropriate than a tax based on weight. Assessing a tax based on volume would be very difficult. A tax based on weight could be more feasible to administer, but might cause unwanted substitutions that would actually decrease the level of recycling. Such a tax would favor lightweight materials, such as plastics, over heavy materials such as glass or steel, even though plastics take up comparatively more space in landfills.[3] Plastics are also more difficult to recycle than glass and thus more likely to end up in landfills. One solution would be to adjust the per-ton tax according to the volume-to-weight ratio of the material. The tax could be also be adjusted according to the toxicity of materials.

Parties Affected by the Policy

All U.S. producers and importers of products containing the covered materials would be directly affected by the policy. Consumers would be indirectly affected by the increase in the cost of products containing taxable virgin materials. The case study in the Appendix indicates the

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2. Organization for Economic Cooperation and Development, *The Application of Economic Instruments for Environmental Protection in OECD Countries*, ENV(88)21 (November 1988); Wallace Oates, "The Role of Economic Incentives in Environmental Policy," presented at the American Economic Association's annual meetings (December 1988); Robert Hahn, "Economic Prescription for Environmental Problems: How the Patient Followed the Doctor's Orders," *Journal of Economic Perspectives*, vol. 3, no. 2 (Spring 1989).

3. In 1988, glass accounted for 7.1 percent of discarded municipal solid waste by weight, but only 2 percent by volume. Plastics accounted for 9.2 percent of discards by weight and 19.9 percent by volume. Environmental Protection Agency, *Characterization of Municipal Solid Waste in the United States: 1990 Update*, EPA/530-SW-900041 (June 1990).

number of producers and importers that would be directly affected by a tax on the virgin content of newsprint.

Information Requirements

Information necessary to administer the policy would vary depending on whether or not the tax was restricted to virgin materials contained in specific products. If the tax covered selected virgin materials, regardless of the products containing them, it could be assessed on the basic raw material. To ensure that the virgin material content of all domestically produced goods was subject to the tax, the government would have to tax all manufacturers and importers of the raw material according to their total sales.

Applying the tax to imported finished products, however, would be considerably more difficult, since the government would need information on the virgin material content of all imported products. Most importers would be unlikely to know the virgin material content of their goods; for example, it is unlikely that an importer of bottles of wine contained in cardboard boxes would know the amount of virgin material in either the bottles or the boxes. How this tax was applied to imported products would determine whether it advantaged or disadvantaged domestically produced goods. Failure to exempt recycled materials contained in imports from the tax would place imports at a competitive disadvantage (and would probably be a violation of the General Agreement on Tariffs and Trade). To the extent that these difficulties resulted in a failure to collect the tax on imports, the policy would make domestically produced goods less competitive.

The administrative difficulties associated with imports could be reduced by limiting the policy to taxable virgin materials contained in specific products--for example, the wood contained in newsprint. Then, the government would only need information on the virgin content of imported newsprint, rather than on all imported paper and paperboard products.

Narrowing the tax to cover virgin materials contained in specific products would reduce the problem associated with assessing the tax

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on imports (simply because the number of covered imported goods would be smaller) but would complicate the process of assessing the tax on domestically produced goods. This is because the tax could not be assessed "upstream" on the relatively few manufacturers of raw materials (such as wood) but would have to be assessed "downstream" on the potentially larger number of firms that use the raw material--that is, the manufacturers of the specific paper products subject to the tax. It would be easiest to verify the virgin material content of specific products if the use of virgin materials was linked to the presence or absence of capital equipment. Administrative difficulties would be further reduced if there were only a small number of domestic producers and if imports of the specific item constituted a relatively small share of domestic consumption.

CHAPTER VI

AN INVESTMENT TAX CREDIT FOR RECYCLING

Under an investment tax credit for recycling, businesses would be allowed to subtract a portion of the cost of qualifying capital equipment from their federal tax liability. Qualifying capital equipment might include equipment used in collecting, separating, and processing recycled materials or in manufacturing recycled products. The types of equipment that would be eligible would depend on the design of the tax credit. Some of the types of capital equipment necessary to use recycled glass, paper, aluminum, and plastic are described in Box 4.

The amount of investment in recycling equipment, and the amount of recycling, should increase with the introduction of an investment tax credit. An investment tax credit would reduce the cost of capital for some firms. Firms with no current tax liability would not immediately benefit from the credit. Municipalities and nonprofit organizations, which are often involved in the collection of recycled materials, would not benefit.

Even if many firms could benefit from the tax credit, questions may be raised as to the effectiveness of this policy. An investment tax credit would reduce the cost of capital, but firms' decisions to invest are determined by many factors in addition to the cost of capital. To some extent, the tax credit might simply subsidize investment that would have occurred anyway. Studies of past investment tax credits and other aspects of the tax law that affect the cost of capital have not shown that such provisions have significantly affected business investment decisions.[1]

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1. Barry P. Bosworth, "Taxes and Investment Recovery," *Brookings Papers on Economic Activity* (1:1985), pp. 1-38; and Joel Slemrod, "Taxation and Business Investment," in Philip Cagan, ed., *Essays in Contemporary Economic Problems, 1986: The Impact of the Reagan Program* (Washington, D.C.: American Enterprise Institute, 1986).

BOX 4
Examples of Capital That Might Qualify for an Investment Tax Credit

Some of the types of capital equipment that might be eligible for an investment tax credit are listed below, in connection with the recycled materials they process. This list is only illustrative, and is not meant to be complete or definitive.

Scrap Aluminum

Aluminum accounts for 1.4 percent of the weight of all municipal solid waste generated. In 1988, 32 percent of all scrap aluminum was recycled. The two largest end uses for scrap aluminum are can sheet (used to make aluminum cans) and foundry ingot (mainly made into castings for products such as buses and trucks). The use of scrap aluminum in these operations requires special processing equipment to delacquer, sort, shred, and otherwise prepare the scrap aluminum for smelting. This equipment is dedicated solely to the use of scrap material. The smelting furnaces used in these operations, however, are not uniquely dedicated to the use of scrap materials. For example, a can sheet manufacturer could use virgin materials or recycled materials in the same smelter during different time periods. However, secondary smelters that produce foundry ingot would be unlikely to use their smelters to process virgin materials. Whether or not any smelting equipment would be eligible for the tax credit would depend on the way in which eligibility was defined.

Scrap Plastics

Plastics account for 8 percent of the weight of municipal solid waste generated. Slightly over 1 percent of all scrap plastics were recycled in 1988. Current recycling of post-consumer plastics is focused almost entirely on containers that are made from two resins, polyethylene terephthalate (PET) and high-density polyethylene (HDPE). PET is found in soft-drink bottles and HDPE is found in milk jugs and the base cups for PET soft-drink bottles. Scrap plastics are made into a variety of end products, including lumber substitutes, carpet backing, pails, strapping tape, fiberfill, and detergent bot-

tles. Converting scrap plastics into useful inputs for a wide variety of end uses requires special processing equipment, including sorters and separators, balers and debalers, and washing and drying systems. This equipment is dedicated to the use of scrap plastics. Other equipment used in processing the scrap plastics into pellets for reuse (called an extruder) is not exclusive to the use of scrap and might or might not be covered, depending on how the tax credit was defined.

Scrap Glass

Glass accounts for 7 percent of municipal solid waste. In 1988, 12 percent of all scrap glass was recycled. The major end use for scrap glass is in the manufacture of new glass containers, although there are a variety of other end uses, including fiberglass and "glassphalt"--an asphalt in which scrap glass replaces some of the stone. Special equipment used in processing glass for a variety of end uses includes sorting equipment and crushing equipment. In order to prepare scrap glass for use in making glass containers it must be sent to a beneficiation facility where contaminants are removed and it is further crushed. This type of equipment is solely dedicated to the use of scrap glass. Scrap glass is made into new glass containers with furnaces that may be used with either scrap glass or virgin materials.

Scrap Paper

Paper is the largest single item in the municipal solid waste stream, accounting for 40 percent of all of the waste generated. In 1988, 25.6 percent of all the waste paper generated was recovered. Domestic paper and paperboard producers are the largest users of recovered paper, but exports account for a large and growing share. Capital equipment used in processing scrap paper includes separating equipment--such as air classifiers, which remove heavy materials; cleaning equipment, which removes substances such as glue; and deinking equipment, which removes inks. This equipment is used solely with scrap paper. The paper machines used in producing recycled newsprint are the same as those used in producing virgin newsprint. Eligibility would depend on the design and interpretation of the tax credit.

If the tax credit was effective in increasing investment, it could bring about an increase in the recycled content of products made with capital equipment that was eligible for the credit. It might also increase the overall level of recycling. The extent to which overall recycling would rise would depend on the source of the recycled materials used in those production activities eligible for the tax credit. These materials could be bid away from other uses, such as exports, that did not benefit from the tax credit. Or the greater demand for recycled materials could generate more collection from households, causing an increase in overall recycling. Which of these effects dominated would depend upon how responsive the various sources of demand and supply of the recycled materials were to changes in prices.

Investment tax credits have existed in the past. A general investment tax credit was instituted under the Revenue Act of 1962. It was suspended twice in the 1960s and restored in 1971. The investment tax credit was revised significantly under the Economic Recovery Tax Act of 1981 and the Tax Equity and Fiscal Responsibility Act of 1982.[2] It was repealed in the Tax Reform Act of 1986.

A federal tax credit for the purchase of recycling equipment was instituted as part of the business energy investment tax credit enacted under the Energy Tax Act of 1978. In general, the credit equaled 10 percent of the purchase price of new recycling equipment placed in service between October 1, 1978, and January 1, 1983. In some cases, the investment in recycling equipment was also eligible for the 10 percent regular investment tax credit. While no federal investment tax credit remains, five states have investment tax credits designed to encourage investments in recycling.

Some opposition to an investment tax credit might arise because the budgetary cost of such a credit is not easily controllable. The cost of a tax credit would not be subject to annual budgetary review, as would a grant program designed to achieve similar ends. Adopting this or any other tax could also be seen as reneging on the compromise worked out in the Tax Reform Act of 1986.

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2. See Congressional Budget Office, *Revising the Corporate Income Tax* (May 1985), pp. 20-26, for a more detailed historical description of the investment tax credit.

INCENTIVES FOR PRODUCERS

An investment tax credit could have two effects on producers that use recycled materials. First, there would be a direct effect on those eligible for the credit, through a drop in the net cost of investment. And second, there could be an indirect effect on all users of recycled materials, through changes in the prices of these materials. Prices would tend to rise if increased investment in capital equipment caused the demand for recycled materials to rise. Prices would tend to fall if collectors were able to take advantage of the credit and, as a result, supplied more recycled materials. Which of these effects would dominate could differ among the various types of recycled materials. Exporters of recycled materials are important final users who would receive little or no direct benefit because they have minimal capital requirements. Producers who already have the capital equipment necessary to use recycled materials would not directly benefit from the tax credit either.

Some states now have investment tax credits. Oregon has the most expansive program, with three separate tax credits: the Business Energy Tax Credit covers equipment used solely for recycling; the Pollution Control Facility Tax Credit covers equipment, land, and buildings used for recycling; and the Plastics Recycling Act covers machinery and equipment used for reclaiming plastic and making it into a product. Two examples of projects that received tax credits under the Pollution Control Facility Tax Credit were a $23.8 million battery-recycling plant and a $13.3 million facility for deinking old newspapers. The battery-recycling facility, which accounted for a large share of the total dollars of the tax credits granted under this program, is no longer in operation.[3] No rigorous analysis of Oregon's tax credit programs exists, although in a survey of recipients one-third indicated that their investment decisions hinged on the tax credit.

An investigation of the desirability of adopting a state investment tax credit to encourage recycling in Illinois concluded that such a measure would not be effective. The study found that state taxes accounted

3. Franklin Associates, Ltd., *Economic Incentives and Disincentives for Recycling of Municipal Solid Waste*, prepared for the Congress of the United States, Office of Technology Assessment (December 1988), p. 120.

for less than 1 percent of gross business sales. None of the industry representatives surveyed said this level of potential impact would be enough to stimulate changes in their business decisions.[4] A federal investment tax credit would, however, be expected to have a larger effect since federal taxes are substantially larger than state taxes.

INCENTIVES FOR COLLECTORS

The investment tax credit could affect collectors in two ways. If collection equipment was eligible for the tax credit, it would reduce collectors' costs of supplying recycled materials. Nonprofit organizations and local governments that act as collectors would not receive this direct benefit, however, since they do not pay taxes. A very generous investment tax credit might induce some nonprofit institutions or local governments to contract for collection services with private firms, which could benefit from the tax credit.

If the investment tax credit brought about changes in at least some producers' decisions about making recycled products, the policy would lead to an increase in the demand for recycled materials and, therefore, put upward pressure on their prices. The combined effect of lower collection costs and increased demand for recycled materials would cause collectors to increase the quantity of recycled materials that they sell.

Unlike the other policies described in this report (with the exception of unit-based pricing), the investment tax credit could be designed to encourage composting. For example, the equipment necessary to collect yard waste could be made eligible for a tax credit.

4. Franklin Associates, Ltd., *Feasibility of Tax Incentives for Purchases of Recycling Equipment or Recycled Products*, prepared for Illinois Department of Energy and Natural Resources, ILENR/RE-EA-87/06 (May 1987), p. 1-4.

INCENTIVES FOR HOUSEHOLDS

An investment tax credit could cause the prices of goods produced with the eligible capital equipment to fall, leading to greater consumption of those goods by households--and possibly an increase in the amount of waste generated. Unlike a system of ideal unit-based pricing, this policy would not necessarily lead to more or less consumption of goods based on how much waste is associated with them.

An investment tax credit could result in an increase in household recycling if it increased the incentive for collectors to provide households with convenient opportunities for recycling. In addition, the tax credit could encourage composting activities if it was provided for investments in this activity. However, like the policies described above, an investment tax credit would not encourage households to reuse products within their homes.

ADMINISTERING AN INVESTMENT TAX CREDIT

An investment tax credit could cover a wide range of recycled materials and would be easy to administer relative to the other policies considered in this study.

Materials Covered by the Policy

The tax credit would affect virtually all types of recycled materials if it covered collection equipment. It would additionally affect recycled materials used in manufacturing processes that require extensive amounts of qualifying capital equipment. Some examples of the types of investments that might qualify for a tax credit are given in Box 4.

Parties Affected by the Policy

As described above, all final users of recycled materials would benefit indirectly from the policy to the extent that it subsidized collection costs and lowered prices. Firms that require capital equipment in pro-

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cessing and using recycled materials in their manufacturing processes would benefit directly from the policy. Consumers would be affected indirectly by any resulting price changes.

Information Requirements

An important issue in establishing and administering an investment tax credit would be to choose the types of investments that would qualify for it. The Internal Revenue Service might rely on technical experts from the EPA to decide what would qualify, unless eligible investments were specified in detail in the law. Retaining some administrative flexibility would allow the tax credit to be applied to new types of recycling equipment or used to encourage innovative uses of existing types of capital that might not be specified in the law.

Once eligible investments were determined, firms making such investments would identify themselves to the government. This procedure would reduce the need for the government to identify the firms affected by the policy, as it would have to do under some of the other policies considered in this study.

CHAPTER VII

A RECYCLING CREDIT SYSTEM

Under a recycling credit system, the federal government would set a required recovery rate for selected items in the waste stream (referred to as covered items). Producers and importers of covered items would comply with the policy by purchasing "recycling credits" for the required percentage of items that they sold. Firms that used the recovered items in their production process or exported them would generate recycling credits to sell. The credit system would help to ensure that the required recovery was achieved at the lowest cost to society.

The types of items that might be covered by this policy are similar to those that might be covered by the disposal tax/reuse subsidy. All of the items listed in Table 1 could be considered as candidates for a recycling credit system, with the exception of disposable diapers.

Since this policy would encourage all end uses of the recycled materials, it would more closely approach the incentives provided by ideal pricing than would a virgin material tax or an investment tax credit, which would only encourage some end uses of recycled materials.

Administrative costs are important to consider in evaluating this policy, as with the other policies discussed in this study. One of the biggest challenges in enforcing this policy would be verifying the number of credits generated by final users of recycled materials. The success of the policy would depend on the development of an active and competitive market for recycling credits. Brokers and long-term contracts would be likely to emerge in order to facilitate the exchange of credits.

The Congress is currently considering two proposals that use this type of system. H.R. 872 and S. 399 would set an overall recovery rate for used oil. H.R. 871 and S. 396 would set an overall recovery rate for tires. These proposals would allow producers and importers of the

covered materials to recycle the materials themselves or to purchase recycling credits from other final users, thus encouraging all environmentally sound end uses of tires and used oil.

INCENTIVES FOR PRODUCERS

A recycling credit system would raise the cost of producing and importing the covered products because producers and importers would be responsible for ensuring the recovery of a given percentage of those products. For example, if the recovery rate for polyethylene terephthalate (PET) containers (generally used in soft-drink containers) was set at 40 percent, producers and importers of PET containers would have to ensure that 4 tons of PET were recycled for every 10 tons of PET they produced.[1] They would fulfill this responsibility by purchasing 4 recycling credits for every 10 tons of PET containers they sold. This requirement would raise their production costs.

Like ideal pricing, a recycling credit policy could be designed to encourage all end uses of the covered materials. Final users of recycled PET would be able to generate credits to sell to producers and importers of PET containers. Producers of PET containers might choose to reuse old containers themselves (and generate their own credits) or to buy credits from firms that exported PET or used it domestically in producing a variety of products, such as carpet backing.

An advantage of this policy is that it would ensure that the desired recycling rate was met. The tax/subsidy, virgin material tax, and investment tax credit described above all depend on how producers respond to changes in relative prices. Uncertainty about their responses makes it harder to know how a particular tax or subsidy would affect the rate of recycling or the amount of waste disposed of.

A disadvantage of this policy would be the difficulty of predicting the cost to industry, or to society, of achieving the stated recycling requirement. Policymakers would set the recycling requirement, but the

1. The current recovery rate for PET containers is 30 percent. See *Resource Recycling*, vol. 10, no. 6 (June 1991), p. 88.

price of meeting it would depend on the level of the requirement and on the price of the recycling credits. The price of the recycling credits, in turn, would be determined by the market. The price of credits would tend to be low when it was easy for producers and exporters to increase their use of recycled materials. The higher the recycling requirement was set, and the more difficult it was for final users to expand their use of the covered materials, the more costly the policy would be for producers and society. Because the recycling requirement would have to be met regardless of the cost, care would have to be taken in setting it. Ideally, the recycling requirement would be set so that the costs of the changes in behavior that it would bring about were commensurate with the benefits society received from those changes. Determining the benefits and costs of alternative recycling requirements would, however, be a very difficult task.

INCENTIVES FOR COLLECTORS

The quantity of covered secondary materials provided by recycling programs would be expected to increase under this policy. The recycling credit system would lead to an increase in the demand for covered secondary materials by all final users and, therefore, to higher prices of recycled materials. Higher prices, in turn, would increase the revenue that collectors received from recycling. Collectors would encourage households to supply more recycled materials by paying them directly or by providing convenient opportunities for recycling.

INCENTIVES FOR HOUSEHOLDS

A recycling credit system would reduce consumption of the products covered by the policy because it would raise the cost of producing them and lead to higher prices. The extent to which the prices of covered products would rise would depend on the level of the recycling requirement that was set, the amount of recycled materials used in each of the covered products, the difficulty of increasing the use of recycled materials among all possible end uses, and the extent to which producers were able to pass cost increases on to consumers. The extent

to which consumers decreased their consumption when prices of covered items rose would depend on the availability of substitutes.

Household recycling of covered materials would increase under the policy as collectors offered more convenient recycling programs. However, like the policies described above, a recycling credit system would not encourage households to undertake all possible disposal reduction activities. For example, it would not provide households with an incentive to reuse products within their homes or to compost waste.

POLICY VARIATION: A RECYCLED CONTENT REQUIREMENT WITH A RECYCLING CREDIT SYSTEM

An alternative policy would set a recycled *content* requirement for products as opposed to an overall recycling requirement. Under this policy, producers and importers of covered products would be required to use a certain percentage of recycled materials in making their product, or they would have to buy credits from other producers or importers that exceeded the recycled content standard. For example, if the recycled content for PET containers was set at 10 percent, manufacturers or importers who sold containers having a recycled content greater than 10 percent could sell recycling credits to producers or importers who sold containers having less than 10 percent recycled content.

Legislation is currently under consideration that would set the recycled content levels for two different products. H.R. 873 and S. 397 would set the recycled content for newsprint, and H.R. 870 and S. 398 would set the recycled content for lead-acid batteries. These proposals would ensure the recycled content of the regulated products, but would not ensure the overall recovery rate of old newspapers or batteries.

A disadvantage of a recycled content requirement is that it would not encourage all end uses of the covered materials. A recycled content requirement would encourage the recycling of covered materials back into the original product, but not into alternative products. For example, it would encourage the use of old PET containers in the manufacture of new PET containers but not in other uses, such as making carpet backing or exporting scrap plastics.

This aspect of the policy raises two problems. First, it would force recycled materials to be reused in the covered product even when it might be cheaper to export these materials or use them in other domestic products. These other uses could be "crowded out" as the prices of recycled materials rose. Second, although the policy would guarantee the recycled content of the covered product, it would not guarantee an overall level of recycling of the covered materials. If a significant amount of crowding out occurred, there might be little increase in the overall level of recycling. In that case, the net result of the policy would be to shift recycled materials from one end use to another, but not to reduce waste disposal.

An advantage of a recycled content requirement over an overall recycling requirement is that it would reduce the administrative costs of the policy. Only firms that turned recycled materials back into their original final product would be eligible to generate credits. The size of the enforcement universe would therefore be smaller.

ADMINISTERING A RECYCLING CREDIT SYSTEM

Recycling credit requirements on covered products could be assessed on the basis of weight or on a specific basis depending on the characteristics of the product. Credits generated would be based on the quantity of recycled materials that were reused. The success of the policy would depend on the development of an active and competitive market for recycling credits.

Materials Covered by the Policy

As with the disposal tax and reuse subsidy described above, this policy would be easiest to administer for products that:

- Are not subsumed in other products and can be easily identified;
- Have a limited number of producers and importers; or
- Have a limited number of final users.

Candidate items for this policy include all of those listed as candidates for the disposal tax and reuse subsidy, with the exception of disposable diapers. The potential for increasing diaper recycling is likely to be limited.

Different units could be used for determining recycling credit requirements and for generating recycling credits. For example, the number of recycling credits that each producer or importer of glass containers required could be based on the *number* of containers they produced or imported, while one recycling credit could be generated for each *ton* of glass that was recycled. This procedure would eliminate the need to identify the weight of glass in imported goods. For a product such as newsprint, both recycling credit requirements and recycling credits generated could be measured per ton.

Parties Affected by the Policy

All domestic producers and importers of the covered product would be affected by the policy, as well as all major final users of the recovered material. Domestic producers and importers would be required to buy recycling credits (with the exception of those producers that could meet their credit requirements internally), and consequently their production costs would increase. Consumers of these products would be indirectly affected by any resulting price increases.

Final users of the specified materials would be eligible to generate credits. Eligibility should be limited to final users who can reuse the products in an environmentally sound manner. Eligibility could also be restricted to major final users in order to reduce the administrative burden by limiting the number of firms able to generate credits.

Information Requirements

If firms complied with the policy, the target recycling rate for covered products would be met. To identify the universe of firms that must comply with the policy, the government would need a complete list of domestic producers and importers of covered products. Information on

domestic producers is often available through trade associations. Information on importers is available from Customs, but it is classified.

To determine whether the producers and importers of the covered product were in compliance, the government would need the following information for each firm:

- The total quantity of the covered good produced or imported; and
- The number of recycling credits purchased and whom they were purchased from.

For each eligible final user of the covered materials, the government would need the following information:

- The quantity of the covered material used during the reporting period; and
- The number of recycling credits sold and whom they were sold to.

Information on recycling credit sales and purchases would facilitate enforcement by allowing the government to cross-check information between firms. The Environmental Protection Agency found that this kind of cross-checking enhanced enforcement efforts in a program that was designed to phase down the lead content of gasoline.

Other Concerns

A recycling credit system could be an efficient (low-cost) way to achieve a desired recovery level because firms with the lowest costs of using recycled materials would be encouraged to do so. The credits would have to be freely traded in a competitive market in order to obtain all the potential cost savings associated with a recycling credit system. Three factors that would affect the willingness of firms to buy and sell recycling credits are:

- The level of transaction costs;
- The structure of the market for recycling credits; and
- The amount of uncertainty associated with credit transactions.

Transaction Costs. Transaction costs are the costs of identifying potential buyers and sellers of credits and negotiating and completing a trade. Transaction costs tend to be low when information on potential buyers and sellers is publicly available. Regulatory costs associated with completing a trade, imposed by regulatory agencies on transactions, are a potential source of high transaction costs. Constraints on who may trade credits, requirements for justification of trades, and the requirement of agency approval of trades are all examples of regulatory costs. Agencies are more likely to place regulatory constraints on trades in cases in which there is a concern about the creation of environmental "hot spots." For example, under emissions trading programs, trades must be restricted so that not too many firms are allowed to emit pollutants into a single air shed or waterway. Since the goal of the recycling credit system would be merely to ensure an overall recovery level for recycled materials, few if any regulatory constraints would be necessary.

Structure of the Market for Recycling Credits. In order to minimize the total cost of achieving the desired recovery rate for recycled materials, the market for credits must be competitive--that is, no individual buyer or seller should be able to influence the price of credits. The market for credits would tend to be competitive if there were a large number of buyers and sellers and there were no significant barriers to entry. (Large numbers of buyers and sellers also could lead to relatively large costs of administering the policy.)

Firms that are large enough to influence the price of credits might wish to do so for several reasons. Buyers of credits would like to keep credit prices low to minimize their costs. Sellers would like to keep recycling credit prices high to maximize their profits from selling credits. Finally, firms might wish to manipulate prices in the credit market to drive up the costs of their competitors and increase their own

shares of the market for the covered products. For example, a recycled newsprint producer might wish to drive up the price of recycling credits in order to increase the costs of producers of virgin newsprint and, thus, increase the producer's own share of the newsprint market.

Uncertainty in Permit Transactions. Firms can be expected to trade credits freely only if there is little or no question involving the legitimacy of the transactions. An important source of uncertainty for credit buyers would be whether the firm that sold them the credits was legitimately generating them. A potential solution for this would be to hold the sellers rather than the buyers accountable for the legitimacy of the credits.[2]

Uncertainty about the future price of recycling credits might also make firms reluctant to depend on buying them or to make investments that allowed them to sell credits. Long-term contracts between credit buyers and sellers would be a way to reduce the uncertainty of both. A long-term contract would offer a firm that planned to buy credits certainty about how much it would need to spend on them in the future. Likewise, it would offer a firm that sold credits certainty as to how much revenue it could expect from its future sales. This assurance would be especially important for a firm that needed to make a large capital investment in order to increase its use of secondary materials. A long-term contract for credits would help reduce the uncertainty associated with the return on the investment.

2 A type of credit system was used to phase down the lead content of gasoline. Under this program, buyers of counterfeit lead rights (credits) were held liable and were considered to be out of compliance. However, information on whether the purchaser of counterfeit lead rights had any reason to suspect that they were counterfeit was taken into account in determining enforcement actions.

CHAPTER VIII

CONCLUSIONS

In an ideal system of waste disposal, households would be charged according to the amount and toxicity of their waste. Under this system, households would have an incentive to consider disposal costs when deciding on the amount of disposal-reducing activities to take. Such activities might include altering their purchasing patterns, reusing products within their homes, recycling, and composting. While an ideal pricing system would result in the optimal level of waste disposal, such a system would be impossible to administer.

Some communities have attempted to approach the ideal pricing system through unit-based pricing--that is, by charging households according to the amount (but not toxicity) of their waste. While these programs hold a great deal of promise, they leave unanswered many questions about the types of communities in which they would be successful. A particular concern with unit-based pricing programs is illegal disposal, and further information on the cost of administering these programs would be useful.

This report has considered four policies that might be used on a national basis to help reduce the amount of waste disposal: a disposal tax/reuse subsidy, a virgin material tax, an investment tax credit for recycling, and a recycling credit system. Each of these policies has advantages and limitations. Each of them would affect only selected items in the waste stream, and none of them would provide an incentive to undertake the full range of disposal-reducing activities. None of the four policies would provide an incentive for households to reuse items within the home, and only the investment tax credit could provide encouragement for composting activities.

All four policies have an advantage over unit-based pricing programs in that they would not provide an incentive for illegal waste disposal. In addition, the disposal tax/reuse subsidy policy and a recycling

credit system could be targeted at diverting toxic or hard-to-dispose-of items from the waste stream. A virgin material tax could also be varied among materials according to their toxicity. Table 2 provides a summary of several important characteristics of unit-based pricing and the four policies analyzed in this report.

TABLE 2. CHARACTERISTICS OF FIVE POLICIES DESIGNED TO REDUCE WASTE DISPOSAL

Policy	Range of Coverage	Displaces Recycled Materials in End Uses?	Discourages Consumption of Waste-Intensive Items?
Applied Unit-Based Pricing	All items in waste stream	No	Yes for bulky or heavy items. No for toxic items
Disposal Tax and Reuse Subsidy	Selected items	Only in minor end uses	Yes for covered items. Tax could be set to reflect toxicity and volume
Virgin Material Tax	Probably specific virgin materials in selected items	Those that do not serve as substitutes for covered virgin materials, including exports	Discourages consumption of items containing covered virgin materials
Investment Tax Credit	Recycled materials in end uses that qualify for tax credit	Significant displacement: exports, end users with existing capital equipment, end uses that do not require qualifying capital	No. Could encourage consumption of items that qualify for tax credit
Recycling Credit System	Selected items	Only in minor end uses	Discourages consumption of covered items

(Continued)

A desirable feature of the disposal tax/reuse subsidy policy and of the recycling credit system is that they could encourage all end uses of recycled materials covered by the policy. For example, if the policies were applied to newsprint production they would provide an incentive

TABLE 2. Continued

Policy	Encourages Illegal Disposal?	Easy to Administer?	General Comments
Applied Unit-Based Pricing	Yes	May require new billing system for waste collection, or distribution system for bags. Enforcement is primary concern	Promising, but many questions arise about types of communities where it would be successful
Disposal Tax and Reuse Subsidy	No	Government must assess tax, distribute subsidy, distribute remaining funds. Verifying subsidy eligibility would be biggest task	Provides an incentive to balance costs and benefits. May be particularly useful for toxic or hard-to-dispose-of items
Virgin Material Tax	No	Administration very difficult for imports	Limited effectiveness unless it covers broad range of virgin materials. Widening coverage would complicate administration
Investment Tax Credit	No	Relatively easy to implement	May subsidize investments without decreasing disposal. Equity issue associated with uneven coverage
Recycling Credit System	No	Government must assess credit requirements and verify credit sales. Verifying legitimacy of credits sold would be biggest task	Unique in that it guarantees a recycling rate. Recycling rate must be carefully chosen. May be particularly useful for toxic or hard-to-dispose-of items

SOURCE: Congressional Budget Office

for all major final users of old newspapers to increase their use (although other final end users might be exempted to reduce administrative costs). In this respect, these policies are similar to ideal pricing. A virgin material tax and an investment tax credit, however, would only encourage selected end uses of covered recycled materials. For example, a virgin material tax would only encourage increased use of old newspapers in cases in which they replaced taxable virgin materials, and an investment tax credit would primarily encourage increased use of old newspapers in production processes that require capital solely dedicated to recycling. Exports are an important and growing use of recycled materials that would not be encouraged by either a virgin material tax or an investment tax credit. End uses that were not directly encouraged by a virgin material tax or an investment tax credit could actually be discouraged by these policies. In that event, increases in prices of recycled materials could "crowd out" end uses that were not directly encouraged.

A disposal tax/reuse subsidy policy would provide households with an incentive to reduce their purchases of waste-intensive items covered by the policy and to increase their recycling of those items. An advantage of this policy is that it could encourage these behavioral changes up to the point at which the additional costs incurred were equal to the benefits society received in the form of disposal costs avoided. But this balancing of costs and benefits would occur only if the disposal tax and reuse subsidy were each set at the cost of disposal. Since disposal costs vary throughout the United States, the tax and subsidy should ideally vary among different localities as well. For administrative reasons, however, the tax and subsidy would probably be set at the national average cost of disposal. Administering the policy would involve collecting the tax from producers and importers of covered items, distributing the subsidies to final users of the recycled materials, and distributing the remaining revenue to communities to pay for the disposal costs of the covered items that were not recycled.

An advantage of the recycling credit system is that it could ensure that a specific level of recycling was met. If an active and competitive market for recycling credits developed, this specific level of recycling should occur at the lowest possible cost to producers of the covered items and, hence, to consumers. Although the use of a credit system

would help to ensure that the cost of meeting the recycling target was minimized for producers and consumers, there can be no assurance that this level of cost would be commensurate with the level of benefits received from the increased recycling. Care would have to be taken to set the recycling requirement at an appropriate level. The costs to the government of administering the policy would need to be considered, as well as the cost to producers and consumers. Administering a recycling credit system would involve verifying that producers and importers of covered items bought the required amount of recycling credits and that firms selling recycling credits actually used the appropriate amount of secondary materials.

A virgin material tax would be a relatively difficult policy to administer. The biggest hurdle would be determining the tax on imported items. Importers of most items would be unlikely to know their virgin content, and the government would be unable to verify it. Failure to enforce the policy on imports would place domestically produced goods at a competitive disadvantage. Administration of a virgin material tax would be most feasible on selected items that are primarily produced domestically, or for which the government is able to determine the virgin content. These items would need to be determined on a case-by-case basis. Another problem would be the "crowding out" issue described above. While a virgin material tax could be a desirable policy for conserving domestic natural resources, it might not be the best policy for controlling waste disposal.

An investment tax credit would probably be the easiest to administer of all the policies considered. Administration would be facilitated by the fact that firms eligible for the tax credit would have an incentive to make themselves known to the government, and by the relative ease of verifying the existence of capital equipment eligible for the tax credit. Because the policy would only involve domestic producers, many of the complications resulting from dealing with imports would not arise. A major question, however, is the extent to which an investment tax credit would reduce the amount of waste disposal. If it did not alter investment decisions, but merely subsidized decisions that would have been made in the absence of a tax credit, the policy would result in an expense to the federal government without decreasing the amount of waste disposal. Also, it might raise the cost of recycled materials and crowd out the use of such materials by some manufacturers.

APPENDIX

EFFECTS OF ALTERNATIVE POLICIES ON THE PRODUCTION OF NEWSPRINT, CONSUMPTION OF NEWSPAPERS, AND DISPOSAL OF OLD NEWSPAPERS

The effects of alternative waste disposal policies may be better understood by examining the changes they might bring about when applied to a particular product. This appendix examines the effect that different policies might have on the disposal of old newspapers. The different policies would affect different points in the production, disposal, and reuse of newspapers. Ideal pricing, for example, would directly affect the cost of disposing of old newspapers. A virgin material tax on newsprint (the paper on which newspapers are printed), would directly affect the cost of producing or importing newsprint. Regardless of the initial point at which the intervention took place, however, all five of the policies examined here would ultimately affect the quantity of newspapers produced, consumed, recycled, and disposed of in landfills or incinerators.

The study has assumed that the five policies would all provide strong enough incentives to cause households, collectors, and producers to change their behavior. Factors that would affect the extent to which these policies caused changes in behavior include the availability of substitutes for newspapers (such as radio and TV news programs), how much people valued the convenience of having their own newspapers, how easy it was to substitute old newspapers for virgin materials in the production process, any quality changes perceived to result from that substitution, and the competitiveness of the newsprint industry.

TABLE A-1. MAJOR FINAL USERS OF OLD NEWSPAPERS IN 1988

End Use	Number of Firms	Number of Mills	Tons Used (Thousands)
Domestic			
Recycled Tissue	28	50	214
Recycled Paperboard	93	192	1,330
Recycled Newsprint	7	8	1,420
Exports	47[a]	b	1,038

SOURCE: Congressional Budget Office based on information from the American Paper Institute, Franklin Associates, Ltd., and the Bureau of the Census.

a. Number of exporters reported for December 1990.

b. Not applicable.

PRODUCTION OF NEWSPRINT AND RECOVERY OF OLD NEWSPAPERS

In 1988, Americans read more than 22 billion newspapers, printed on more than 13 million tons of newsprint.[1] More than half of the newsprint was imported, nearly all of it from Canada.

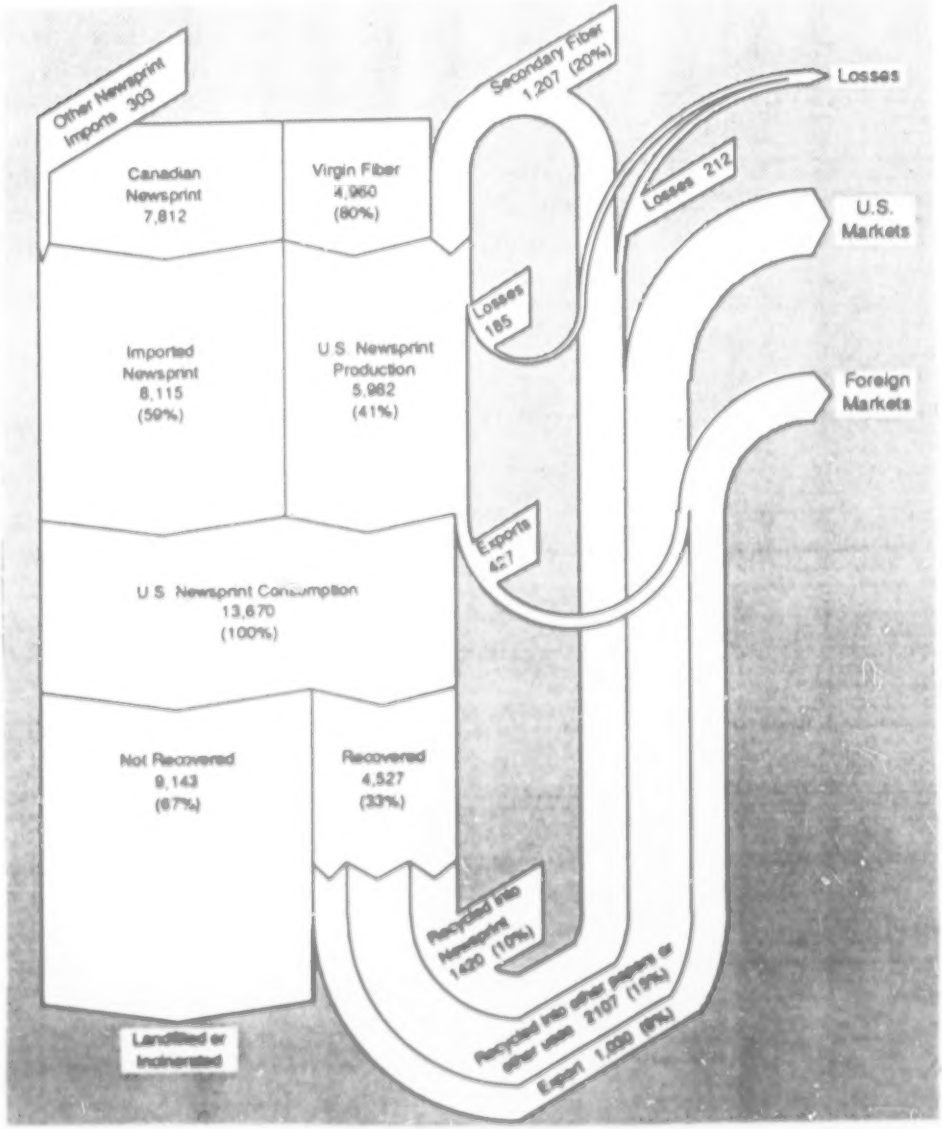
The United States has 20 producers of newsprint, with 23 mills. In 1990, nine mills were producing recycled newsprint. Canada has 19 producers (41 mills), only two of them producing recycled newsprint.[2]

Foreign newsprint is brought into this country by many different importers. Between October 1987 and September 1988, the Customs Service counted 915 importers of newsprint. Foreign producers, U.S. publishers, or customs brokers may all be importers of newsprint.

1. Taylor Bingham, Ram V. Chandran, and Terry Dinan, *The Old Newspapers Problem: Benefit Cost Analysis of a Marketable Permit Policy*, report prepared for the Environmental Protection Agency (February 1990).

2. Franklin Associates, Ltd., "Markets for Selected Postconsumer Waste Paper Grades," final review draft prepared for the Environmental Protection Agency (March 1990).

Figure A-1.
Major Flows of Newsprint and Fiber in the United States in 1988 (In thousands of tons)



SOURCE: Congressional Budget Office from Taylor Bingham, Ram V. Chandran, and Terry Dinan, *The Old Newspapers Problem: Benefit Cost Analysis of a Marketable Permit Policy*, report prepared for the Environmental Protection Agency (February 1990).

According to the Canadian Pulp and Paper Institute, the most common importers of record are either Canadian producers or customs brokers.

One-third of all the newsprint consumed in the United States in 1988 was made from recovered newspapers. Of newspapers recovered in the United States, 31 percent found their way back into U.S. newsprint, nearly 23 percent were exported, and the remainder were used in other domestically produced goods. Some information on the major final users of old U.S. newspapers is given in Table A-1 on page 74. Numerous minor users, including manufacturers of cellulosic insulation, packing material, hydromulch, animal bedding, and molded pulp, accounted for an estimated 10 percent of all the old newspapers recovered in 1988.[3] Major flows of newsprint and fiber are shown in Figure A-1 on page 75.

IDEAL PRICING

Under an ideal pricing system, households would pay the disposal cost for each newspaper that they disposed of. Households that did not recycle would face higher costs for the newspapers that they bought because they would have to include the disposal cost in their purchase decision. Higher costs usually translate into fewer purchases. In order to minimize lost sales, newsprint producers and newspaper publishers would attempt to reduce the cost of disposing of old newspapers as much as possible--for example, by using lighter newsprint and minimizing empty space on the page. This, in turn, would reduce the volume of newspapers in disposal.

Households would put more time and effort into recycling old newspapers in order to reduce their disposal costs. Collectors, in turn, could supply greater quantities of old newspapers at a lower cost. The increased supply and lower prices of old newspapers would encourage final users of old newspapers to use more. Newsprint producers, tissue paper producers, recycled paperboard producers, and exporters are examples of final users.

3. Franklin Associates, Ltd., "Markets for Selected Postconsumer Waste Paper Grades."

An ideal pricing system would need to be enforced. Otherwise, some households would dispose of their newspapers illegally to avoid the disposal fee--by burning them, discarding them, or putting them in commercial dumpsters.

A DISPOSAL TAX AND REUSE SUBSIDY

One of the policies analyzed in this study would involve taxing newspaper production by the amount of the disposal cost and subsidizing all users of recycled newspapers by the amount of the disposal cost avoided by their reuse. This policy could have effects on the production and recovery of newspapers similar to those of ideal pricing. Levying a disposal tax on newspapers, or alternatively on newsprint, would increase the cost of consuming newspapers. Households that valued receiving a newspaper less than its new higher price would cease to purchase newspapers. As with ideal pricing, producers would have an incentive to reduce the disposal cost of their newspapers as much as possible in order to minimize lost sales.

Like ideal pricing, the reuse subsidy would provide an incentive for all final users of recovered newspapers to increase their use of them in production. As the demand for old newspapers rose, their price would also rise. Collectors, in turn, would benefit from the higher prices and would seek to sell more recovered newspapers by making recycling more convenient for households. As described in Chapter II, collectors can reduce household recycling costs by transferring the labor of collecting and sorting to paid employees, thus motivating more households to recycle their newspapers.

All domestic producers and importers of newsprint would be subject to the disposal tax. In order to determine the amount of the tax, the government would need to know how many tons of newsprint were being produced or imported. This information is already routinely collected by the Customs Service for each shipment of newsprint brought into the country.

The reuse subsidy would apply to final users of recovered newspapers. If only major final users were included, approximately 130 do-

mestic firms plus exporters would be eligible for subsidies. If minor final users were eligible for the subsidy as well, the number of firms covered by the policy would grow considerably. Verifying the amount of recovered newspapers used by firms that filed for a subsidy would be one of the major challenges in administering this policy. Verifying the quantities exported would be relatively easy, since this information is currently reported to the government. Verifying the quantities used by domestic firms could be more difficult. Final users might be required to maintain receipts of their purchases from collectors or intermediaries. In some cases, such as newsprint and tissue production, capital equipment is needed to remove the ink from the recovered newsprint. The presence or absence of this deinking equipment could serve as a crude check on the ability of firms to use recovered newspapers and, therefore, to be eligible for subsidies.

The remainder of the disposal tax revenue could be distributed among municipalities to pay for the disposal of newspapers that were not recycled. As discussed in Chapter IV, the distribution might be based on population. This task would increase administrative costs.

A VIRGIN MATERIAL TAX

A virgin material tax would tax the virgin content of all newsprint that is domestically produced and imported. Like an ideal system of unit-based pricing and a disposal tax/reuse subsidy policy, a virgin material tax would raise the cost of consuming newspapers and would, therefore, discourage consumption. Unlike unit-based pricing or the tax/subsidy policy, however, a virgin material tax would discourage the use of only one input in newsprint production--virgin material. If other inputs could be used to increase the amount of newsprint, they would add to the disposal cost that society pays, but would not add to the tax that the newsprint producer pays. For example, if capital investments could be made to increase the amount of newsprint produced from one ton of virgin material, such investments would be discouraged under unit-based pricing but not under the virgin material tax.

Like an ideal system of unit-based pricing and a disposal tax/reuse subsidy policy, a virgin material tax would also result in an increase in

the recycled content of newspapers. A virgin material tax would increase the cost of using virgin material relative to the cost of using old newspapers as an input to newsprint. It would therefore cause more producers to substitute old newspapers for virgin material and increase the recycled content of newsprint.

Unlike ideal pricing and a tax/subsidy policy, however, a virgin material tax would not encourage all end uses of old newspapers. In fact, the virgin material tax would *discourage* uses of old newspapers that did not replace taxable virgin material. If the virgin material tax was applied exclusively to newsprint, it would discourage all non-newsprint uses of old newspapers and thus would raise their price. This higher price would, in turn, crowd out other uses of old newspapers. This crowding out could be significant, since the other uses take up over two-thirds of newspapers recovered.

Five of the 23 newsprint mills in the United States produce 100 percent recycled newsprint (four others produce a mix of recycled and virgin newsprint). Eighteen domestic mills would be expected to pay the tax. All importers of newsprint would also need to comply with the policy. Because imports account for over half of all newsprint consumed in the United States, collecting the tax on imports would be crucial to the policy's success.

To determine whether the covered domestic newsprint producers were in compliance, the government would need the following information for each firm:

- The total weight of finished newsprint derived from virgin fibers during the reporting period; or
- The total weight of virgin pulp used during the reporting period.

Which information would be required would depend on the tax base. Available information on firms' production capacities for total and recycled newsprint would be useful in verifying the information. The amount of recycled newsprint that each firm was capable of producing could be determined from the amount of its deinking equipment.

For each importer, the government would need to have the following information:

- The total weight of finished newsprint derived from virgin fibers for each shipment imported; or
- The total weight of virgin pulp used in each shipment imported.

A key difference between the information requirements for domestic producers and those for importers is that the latter would have to furnish information on the virgin content of *each shipment* of newsprint, rather than the total used in the reporting period.

Enforcement against importers would be aided by the fact that 96 percent of all imported newsprint comes from Canada, and that only two Canadian firms currently have the capacity to produce recycled newsprint. Also, importers are now required to report the newsprint manufacturer to the Customs Service. Newsprint that did not come from one of the two mills producing recycled newsprint could safely be considered to have been made from virgin material, and would be subject to the tax. Of course, this policy could encourage more Canadian firms to develop the capacity to produce recycled newsprint.

AN INVESTMENT TAX CREDIT

Like ideal pricing, and like all of the policies examined in this report, an investment tax credit for capital used in the collecting, separating, and processing of recycled materials could increase the recycled content of newsprint. To the extent that the tax credit reduced the cost of collecting recycled materials, it would lower the cost of old newspapers and other types of scrap paper used in newsprint production. In addition, the tax credit would reduce the cost of capital used to separate contaminants from scrap paper (which may be done by a scrap dealer or by the newsprint manufacturer) and the capital used to deink the scrap paper. These changes could cause some existing firms to begin producing recycled newsprint rather than virgin newsprint, and could motivate firms expanding their production to choose to produce recy-

cled newsprint. Although the recycled content of newsprint could rise under either an investment tax credit or ideal pricing, several important differences exist between the incentives created by the two policies.

An investment tax credit could lead to a higher overall level of newsprint production and newspaper consumption, whereas ideal pricing (and all of the other policies examined in this report) would lead to a lower level. An investment tax credit would decrease the overall cost of producing newsprint (and, therefore, newspapers) by reducing the cost of collecting, separating, and deinking the scrap paper used in production. These cost reductions could result in lower newsprint prices, lower prices for newspapers, and, therefore, an increase in the quantity of newspapers consumed.

The choice of inputs would also be different under an investment tax credit. While both policies would encourage the use of old newspapers (and other types of scrap paper) in producing newsprint, the investment tax credit would not explicitly discourage the use of other inputs that added to the disposal cost of newsprint. For any given price of newsprint, therefore, the amount of other inputs that added to disposal costs would be greater under the investment tax credit than under ideal pricing. If the relationship between deinking equipment and use of old newspapers was not fixed, the investment tax credits would encourage producers to substitute more capital for old newspapers--that is, to produce the same amount of newsprint with more capital and less recycled material--whereas ideal pricing would not encourage this. The investment tax credit is similar to the virgin material tax in this respect. It would encourage substitutions that reduce after-tax expenses for the firm but might not reduce disposal costs.

An investment tax credit would provide relatively little encouragement for uses of old newspapers that require little or no specialized capital equipment for processing them--notably exports of old newspapers and production of recycled paperboard, which took 22 percent and 27 percent of all recovered newspapers in 1988, respectively.[4] These

4. Franklin Associates, Ltd., "Markets for Selected Postconsumer Waste Paper Grades," pp. 3-15, 3-17.

end uses could benefit from the tax credit only to the extent that the credit lowered the prices of old newspapers by lowering collection costs. If the tax credit caused final users with specialized recycling capital to significantly expand their operations, however, prices of old newspapers could rise above what they would otherwise be. In this case, the policy could crowd out end uses that require little or no specialized equipment. The investment tax credit is similar to the virgin material tax in that both policies would encourage some end uses of old newspapers while crowding out others.

Waste collectors and scrap dealers would be eligible for tax credits on equipment that allowed them to collect and separate old newspapers. Newsprint producers who decided to produce recycled newsprint would be able to obtain tax credits on any separating equipment that they purchased as well as on deinking equipment. All virgin newsprint producers would be eligible for the tax credit should they decide to produce recycled newsprint. There are currently 14 mills in the United States without the capacity to produce recycled newsprint. In addition, all potential entrants into the industry would be eligible for the tax credit should they choose to produce recycled newsprint. Tissue producers would also be eligible should they wish to add the deinking equipment necessary to produce recycled tissue. Paperboard manufacturers are major final users of old newspapers but might not benefit significantly from the tax credit because they do not require deinking equipment.

The investment tax credit would be easy to administer relative to the other policies considered in this study. The government would not have to determine tax payments, verify that producers had used old newspapers, or redistribute revenue to municipalities, as under the tax/subsidy policy. Nor would administrators have to determine the virgin material content of newsprint, as they would with the virgin material tax. They would have to verify only a relatively few capital investments by newsprint producers.

A RECYCLING CREDIT SYSTEM

A recycling credit system would ensure an overall recovery rate for old newspapers. Newsprint producers and importers would be responsible for recovering a stipulated percentage of old newspapers. They would meet this requirement by buying recycling credits that certified the reuse of old newspapers. Final users of old newspapers eligible to sell credits would include producers of recycled newsprint, recycled paperboard, and recycled tissue, and exporters of old newspapers. Since domestic newsprint producers would be required to buy credits and would also be eligible to generate credits, they might meet their own credit requirements internally. Producers of recycled newsprint using old newspapers in excess of their own requirements would be able to sell their excess credits.

Like ideal pricing, the tax/subsidy policy, and a virgin material tax, the policy would raise the cost of producing and importing newsprint and therefore raise the price paid for newspapers. Households that valued the convenience of receiving their own newspapers less than the new higher price would no longer purchase newspapers.

Like ideal pricing and the tax/subsidy policy, the recycling credit policy could encourage all end uses of old newspapers. Newsprint producers using more old newspapers than required would be able to subsidize their production by selling credits to newsprint producers using fewer old newspapers than required. Other users of old newspapers, such as tissue producers and exporters, would receive payment for the old newspapers they used (by selling credits). This policy would not potentially crowd out some end uses, as would the virgin material tax and the investment tax credit.

The government would need to verify that domestic producers and importers had complied with the recycling requirements, and to determine the legitimacy of the recycling credits that were generated and sold. The problems associated with doing this would be very similar to those under a disposal tax/reuse subsidy policy. Verifying credit requirements would necessitate obtaining information on the quantity of newsprint produced domestically and imported. Verifying the credits generated would involve the same problem as verifying the eligibility

of firms for reuse subsidies--requiring confirmation of the amount of old newspapers they had used. This would be particularly difficult in the case of final users that did not have to make visible capital investments in order to be able to use old newspapers.

The recycling credit policy would be successful only if transaction costs were sufficiently low. The set of potential buyers of recycling credits would include domestic newsprint producers and importers of newsprint. The set of potential sellers of recycling credits would include all major domestic final users of old newspapers, as well as exporters of them (see Table A-1). Recycling credit brokers might emerge to facilitate transactions among the large number of potential buyers and sellers.

If the goal of the policy was to increase the overall recycling rate of old newspapers in the United States as a whole, there would be little need for regulatory constraints on recycling credit transactions. The regulatory costs should be expected to be low. If concern arose about the distribution of recycled newspapers, regulatory constraints would be necessary. For example, if one goal of the policy was to ensure that the increased demand for old newspapers was evenly distributed across the country, it would be necessary to set up regional zones for trades.

A modified policy that would set an average recycled content of newsprint rather than an overall recycling rate of old newspapers might give rise to noncompetitive behavior. One or two large newsprint producers could potentially influence the price of credits under a 20 percent recycled content standard for newsprint.[5] Under the expanded policy discussed in this study, with the goal being an overall recycling rate for old newspapers, the number of firms that could generate credits would be much larger, making it unlikely that any single generator of credits could influence the price.

Long-term contracts for recycling credits would be likely to emerge as a means of reducing uncertainty for both buyers and sellers. Because it takes approximately three years to buy and install deinking

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5. Terry M. Dinan, "Increasing the Demand for Old Newspapers Through Marketable Permits: Will It Work?" *Proceedings of the Association of Environmental and Resource Economists, Workshop on Market Mechanisms and the Environment* (June 1990).

equipment, buyers of credits would not be able to supply their own credit needs internally (in the short run) if credits were unavailable on the market. In addition, some firms would need to install costly de-inking equipment before they could supply credits to others. All would benefit from increased certainty about the future market for credits.

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